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ECONOMIC GEOGRAPHY

OCTOBER

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Samuel van Valkenburg

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THE IRON ORE RESOURCES OF CHINA
W. Belden and M. Salter

CLARK UNIVERSITY, WORCESTER, MASSACHUSETTS, U.S.A.

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ETHIOPIA

WAR clouds hang heavy over Ethiopia. That primitive relic of early political and economic feudalism faces the fear of conquest and despoliation. Its autonomy of government hangs in the balance, its patriarchal sovereignty over ancient fiefs and tribes is threatened by the ruthless forces of civilization. It stands on the threshold of extinction as an independent state.

Its strategic position politically, its potential wealth of resources, its healthy vigorous peoples, its backwardness of culture, make it an irresistible temptation to those stronger nations suffering economic stress and exaggerated political egotism. It is a powerful lure to colonization and exploitation. It offers a fertile field for the expansion of commerce and trade, for the development of power and industry.

Its strength lies in those fundamental geographic factors which history has emphasized again and again—inaccessibility of location, ruggedness of relief, vicissitudes of tropical climate. Its weakness likewise lies in those same elements of strength. Our civilization has been directed toward means of minimizing or overcoming the disadvantages, in order to make the advantages dominant.

To survive the crisis Ethiopia must seek and find the help of those nations who have already succeeded in making the most of their resources and advantages. To continue to survive, Ethiopia must adopt the methods and means of progress which other nations have employed to safeguard themselves.

The lesson is obvious. No nation may lapse into peace of obscurity and security of isolation without losing its right to continue independent, except by the tolerance of its progressive neighbors.

ECONOMIC GEOGRAPHY

VOL. 11 OCTOBER, 1935 No. 4

AGRICULTURAL REGIONS OF ASIA

PART VIII—MALAYSIA

(*Continued*)

Samuel van Valkenburg

IN THE western part of Malaysia, Malaya and Sumatra form together a distinct unit. Separated only by a shallow strait they show the same arrangement of forested mountains and coastal plains. In fact, Sumatra only recently (geologically speaking) became disconnected from the Asiatic continent, and its fauna and flora are still chiefly continental. But politically and economically Malaya and Sumatra have gone different ways and both are important enough to deserve a more detailed treatment.

MALAYA

Equatorial rain forests still cover the mountain ranges of Malaya where primeval aborigines try to find a scanty sustenance by gathering fruits and yams, or by raising a meager crop of mountain rice amid the burned stumps of trees; but the coastal plains and hills, especially along the western side, have been invaded by strangers—first by groups of Malays from Sumatra who colonized the opposite coast; then by Chinese who came as coolies or as merchants and put their cachet on city life; finally by a small group of white men who became the economic and political leaders.

During the Malay migration the location of Malaya was already an important factor. From the Malay nucleus of Palembang in Sumatra, the Malay farmer brought with him the knowledge of wet rice fields, which, together with the cultivation of coconuts, found an excellent base along the alluvial west coast, while the muddy water of the "Straits" with its abundance of fish produced the third unit of the Malay diet. Here passed the great water trade road between India and China, and cultural influences of these centers of Asiatic civilization infiltrated the coastal settlements. The east coast, away from this line of traffic and missing the connections with Sumatra, did not share in profit from the advantages and followed only slowly along the road of progress.

Through centuries of European colonization, the coming of Portuguese, Dutch, and English, Malaya kept its dual appearance of feudal coastal states under Malay princes and the aboriginal interior, while European influence was limited to a few harbor settlements for trading purposes. The great change came in the nineteenth century. Having obtained, through agreement with the Netherlands, complete control of the peninsula, the power of the British Empire was gradually extended inland in various forms (Straits Settlements, Federated Malay States, Non-Federated Malay States). Singapore, founded on

the south shore of an island in front of Asia's most equatorial point, grew up as one of the world's centers of trade and navigation. Railroads were built, opening the hinterland; roads crossed formerly unspoiled jungle, and the motor car solved the traffic problem.

Tin mines brought riches to the colony; coffee and sugar-cane looked like valuable crops; while Chinese, who began to flock in, cultivated gardens with gambier, pepper, and tapioca.

At the very end of that century came the *Hevea braziliensis*, far-famed rubber tree, opening a new era for Malaya, overshadowing everything in economic importance. Malaya became the chief rubber producing region in the world. One may drive for hours through carefully planted rubber forests, realizing that they contain one of the pillars of our temple of modern civilization.

Still it is necessary to know that of the whole peninsula, only 15% has been brought under cultivation, and the rest still lies under the heavy despotism of dark forest.

THE PHYSIOGRAPHIC BACKGROUND

The mountain backbone is shown in Figure 1B. Several ranges, "en coulisse," run in a general north-south direction, leaving between them a lower hilly country which facilitates transportation and travel inland. Coastal alluvial plains border both sides. The western plain along the shallow Straits shows evidence of constant growth, by accretion. The transition between land and water is gradual; extensive mangrove swamps are flooded at high tide and run dry at ebb. No modern harbors could develop here; the ancient city of Malacca lost its prominence to Penang and Singapore, both located on coastal islands.

The east coast is deeply influenced by the strong winter monsoons which prevent the growth of mangroves; the straight coast line is sandy with a narrow belt of casuarina.

Climatically, three divisions can be distinguished. The south, with its equatorial position, has heavy rainfall throughout the year with a double maximum in spring and fall. This double maximum is also the outstanding feature of the western climate, but the period between the maxima is considerably dryer. The east coast shows the influence of the winter monsoons which gather moisture while passing over the South China Sea and cause a pronounced winter maximum which often results in flood, forcing the population to harvest the rice before the peak of the rainy season. The amount of precipitation is high; south, average 90 inches; west, average 80 inches; east, average 120 inches.

RUBBER

The Malay Peninsula is rubber's paradise. Uniform warm temperatures, plenty of rain which comes in convectional afternoon showers and does not interfere with morning tapping, and a well drained, hilly topography give an ideal combination for the growth of rubber trees. Excellent transportation by road as well as by railway and harbor in close proximity on one of the greatest trade routes have helped this development. Singapore is the world's rubber center, not only for Malaya itself, but also for the adjacent parts of Sumatra and Borneo.

The growth of the product has been phenomenal. In 1905 the export was 104 tons, while coffee and sugar ranked first in agricultural export; in 1912 the export had increased to 15,368 tons and the value was sixty times that of the next rank, copra. At present the production could easily pass the half million ton if the world market permitted it. Its

share in the world production has dropped considerably, especially during the time of the Stevenson restriction, when the non-British estates of the Netherland's East Indies kept on tapping at full capacity.

In 1934 a new rubber restriction plan was agreed upon by the rubber producing regions of the Far East (except Indo China). The accompanying table gives the basic quota for the years 1934–38. From time to time the International Rubber Regulation Committee fixes the percentage of the basic quota, that may be exported.

TABLE I

	1934	*1935*	*1936*	*1937*	*1938*
Malaya	504	538	569	589	602
Netherl. India	352	400	443	467	485
Ceylon	77.50	79	80	81	82.50
India	6.85	8.25	9	9	9.25
Burma	5.15	6.75	8	9	9.25
Br. N. Borneo	12	13	14	15.50	16.50
Serawak	24	21	30	31.50	32
Siam	15	15	15	15	15
Total	996.50	1,088	1,168	1,217	1,251.50

(Basic quota for the exportation of rubber in thousands of long tons.)

The future percentage of world production is accordingly, Malaya 50%, Netherland's East Indies 40%, rest 10%.

Figure 1A shows a veritable rubber belt from Singapore to South Kedah, limited on the west by the water-logged soils of the coastal plain and eastward by elevation as well as distance from lines of transportation. Of course, the belt is not nearly so regular as shown on the map and varies locally a great deal. The rubber development in the east is shown by three dots in areas of marked concentration, Ulu Kelantan in the north, Kuantan in the center, and Kota Tinggi in the south.

RICE

Rice, the main food crop, covers roughly 700,000 acres, of which 600,000 is paddy (Figure 1B). This acreage has been rather stationary and is now no longer sufficient to supply the demand of the rapidly increasing population. The wet rice fields are located in the coastal lowlands. Three areas of concentration can be recognized on the map, each producing rice surplus; namely, the Kota Star region of Kedah, with its irrigation canals, Malaya's first rice producer, Kota Bharu in Kelantan, and the Krian district in northern Perak.

COCONUTS

The areas planted with coconuts almost equal the rice acreage (Figure 1C). A coastal location under influence of the sea breeze forms the major control. The chief producing regions are Lower Perak, Selangor, and the west coast of Johore. The value of export, in the form of copra, coconut oil, and fresh coconuts varies from 60 million to 100 million dollars, according to the world price.

OTHER CROPS

Two other export crops deserve note —palm oil and pineapples. The acreage under palm oils shows a heavy increase from about 2,000 acres in 1924 to 57,000 acres in 1931 and probably a continued increase since. Only part of this is actually in production; in 1931 the amount being—palm oil 5,000 tons and kernel, 800 tons. The leading states are Johore, Perak and Selangor; the distribution is similar to that of the coconuts, namely along the western coastal plain.

The pineapple industry is almost entirely concentrated in Johore, with 35,000 acres out of a total of 50,000 acres. Singapore is the canning center. The export quantity is about 60,000 tons, which goes for the most part to Great Britain. Pineapples are raised as a "catch crop" under the rubber trees, and correspondingly correlate in their distribution with the rubber belt.

SUMATRA

Sumatra, in area the world's fifth island, is an isle of contrasts. While most of it is still sparsely populated and exhibits the cultural retardation typical of equatorial forest regions, some parts of it have advanced to such a degree of civilization that they can be taken as models of possible tropical development. (For names of places see Figure 4B; for population see Figure 3.)

Racially and ethnographically, Sumatra presents a cross section through mankind's culture from ancient days to now. The Kubus in the interior forests of Djambi and Palembang, related to the Vedda of Ceylon, represent one of the lowest anthropological groups of mankind. The pre-Malay element is represented by the Batak and related groups (Gajo, Alas) about Lake Toba and the inhabitants of some of the western islands. Malay, and the related inhabitants of Atjeh (English Acheen and Acheenese) populated the coastal regions and along the eastern rivers penetrated far inland. Malay culture even reaches its peak in the Padang Highlands (the so-called Minangkabau) while under the influence of Hindu missionaries from India Çriwidjaja, the present Palembang was once the political center of the Archipelago.

In the period of European colonization Sumatra did not at first offer as many attractions for trade as Java and the Molluccas, nor such a perfect location as Malaya. The Dutch control was limited to a few coastal trading posts, while the English who came later also did not venture inland. At that time (seventeenth and eighteenth centuries) Atjeh was the most powerful state of Sumatra with a militant, fanatically Mohammedan population; several battles took place to protect the Dutch boats against their raids. It was in Benkulen that Sir Stamford Raffles continued as governor after Java, taken by the British during the Napoleonic wars, was returned to the Kingdom of the Netherlands. Finally in 1825 the remaining English possessions were exchanged for the Dutch interests in Malaya. Since then Sumatra has been under Dutch control. Because Java engaged most of the interests of the government, the expansion of Dutch influence over Sumatra was slow. Up to 1870 the northern part and most of the interior was still independent. Since then the occupation has proceeded more rapidly, until finally the pacification of Atjeh in 1908 marked the end of this long period of extension of sovereignty.

Economic progress followed rapidly. Interest in oil, coal, rubber, and plantation agriculture brought modern life into even the most isolated parts. Numerous steamers now connect the coastal settlements or follow the large rivers far inland. Motor bus services on the excellent roads connect the inland stations. Airplanes now connect it with Java and Malaya. The Dutch lady from Palembang can do her shopping in Batavia and come back the next day, whereas she needed a week for the trip before. Studies are being made to determine how far Sumatra can be used as a field for migration from densely populated Java and South Sumatra. In the Lampongs have already been settled prosperous Javanese colonies.

Finally, in the development of its east-

ern coast, Sumatra displays the perfect example of estate agriculture, a model for other regions. Thus Sumatra hitherto but a somewhat unimportant stepsister to Java, deserves to be known better, for her own virtues, not only in Holland, to whom she owes her government and progress, but to the world at large.

CLIMATE

Equatorial location and insular character of Sumatra make the rainfall, the all-important element of warm climates, everywhere plentiful—in fact nowhere does the annual precipitation fall below 60 inches. Figure 2B shows a definite order in the courses of the isopleths. The east coast and part of the central rift valley are comparatively dry. High rainfall coincides with some of the higher elevations, chiefly along the west coast where the western winds are forced to rise. In North Sumatra the eastern mountain slopes show heavy precipitation only during the time of the Asiatic winter monsoon. The strong west winds during the northern summer are responsible for chinook (foehn) conditions along some of the east slopes in Sumatra north of the equator. The effect of these hot dry fall winds may be observed in the vegetation which here forms a belt of savannas along the mountain base. The distribution of precipitation varies greatly between north and south Sumatra.

In the south the Australian control prevails; drier season between May and November, wet during the southern summer (see rain chart 1 in Figure 2B). This control continues along the eastern lowlands up to the equator, although to a less pronounced degree (see rain chart 2); it is succeeded by the equatorial double maximum (rain chart 3). Along the west coast the equatorial double maximum extends definitely south of the equator; of the two maxima the one during the Asiatic fall is the most important (rain chart 4). North Sumatra shows the influence of the Asiatic monsoons. A pronounced summer maximum prevails along the west coast (rain chart 5) while winter rains are already in evidence east of Lake Toba (rain chart 6) and are the outstanding factor farther north (rain chart 7). In the interior

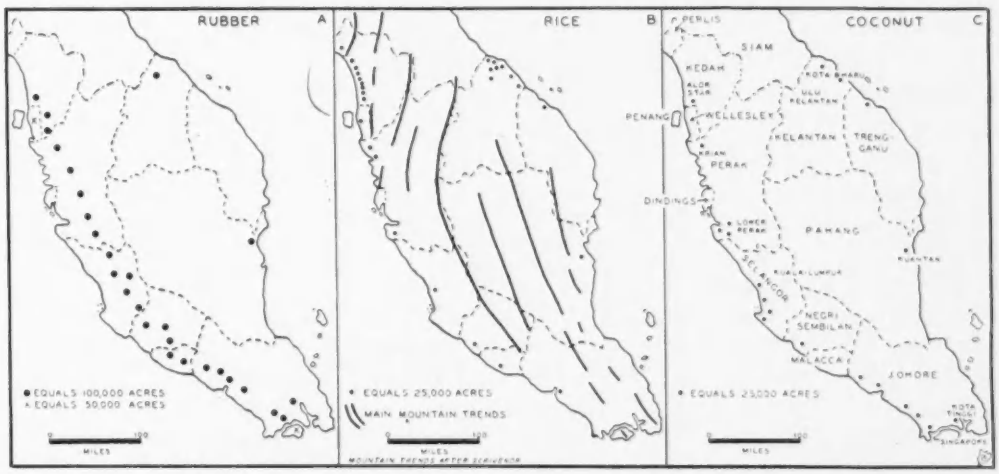

FIGURE 1.—Rubber, rice, and coconut, the three major crops of Malaya, show a zonal arrangement; rice and coconut along the west coast, succeeded farther inland by a zone of rubber production. In the eastern part of Malaya the distribution is more spotty than zonal, with a marked concentration of all three crops in the northeast.

sections, for example in the rift valley, the double maximum extends into the areas with monsoonal coastal control (rain chart 8).

General Description

Seen from the east Sumatra appears an almost continuous mountain range from which different peaks (volcanoes) rise above 10,000 feet. The range is the Bukit Barisan, a feature of the Sunda fold. Except in few places a narrow coastal plain separates the mountain foothills from the ocean (Figure 2A). If not too swampy, as in the wider northern part, the alluvial soils offer suitable conditions for most rice fields; but the many mountain rivers cause frequent floods and prevent land transportation, and the regular coastline on which beat, unbroken by promontories or sheltering islands, the monsoon swells of the ocean, does not facilitate navigation. Only at one spot where a mountain offshoot borders the coast without a fringing coastal lowland to prevent, could a modern harbor be made, namely Emmahaven, south of Padang. Here also is the major development of rice cultivation, which profits from better trade connection though it may also be regarded as an economic overflow from the adjacent Padang Highlands. Still at many places vessels ship on the open roadstead such products of the coast and its hinterland as coffee, pepper, timber, and other forest crops; at two places (Benkulen and Sibolga) road-crossings over the mountains add to its economic significance.

The mountain range itself, with its heavy precipitation is densely forested and in general difficult of traverse; but several river outlets and easy passes lead to the Sumatra Rift valley which extends the entire length of the island. Bordered by volcanoes, and sometimes interrupted by them, this structural depression with its longitudinal valley, and lake depressions, offers in many places excellent conditions for agricultural use of the land. Here where the heat is tempered by elevation and the volcanic soils are fertile, Sumatra attains in some places the agricultural level of Java. Rice is the main grain; in some places even a surplus can be exported. The villages are hidden under the broad foliage of palms and fruit trees, while plots of sugarcane, coffee, tobacco, and many minor crops constitute a rich agricultural variety. The map (Figure 4A) of coffee production shows very well for that crop the importance of the rift valley and surrounding mountains.

Coffee is in Sumatra principally a native crop in contrast to the estate production on Java. After a pronounced slump when the government gave up its policy of forced coffee production, coffee raising revived slowly. In 1932 the export of coffee raised by natives in their small plots was 66,000 tons, which is about one-sixth of the total coffee export of the Netherlands East Indies. The chief center of production is along the border of Benkulen and Palembang. It is interesting to note that although most of the Sumatra coffee is of the *robusta* variety, the coffee *Arabica*, the well-known Java coffee, survived the coffee blight in the more northern regions of production especially about Lake Toba. (W. K. Huitema D. Bevolkings Koffeecultuur op Sumatra, Veenman Wageningen Holland 1935.)

From the Rift the economic development at some places has extended eastwards between the ranges, which open fanwise in that direction. This is especially the case in the southern part where the eastern basin and valleys of the Palembang mountains with their volcanic soils have shared in the agricultural development. The later description of the Padang Highlands will help

to give a sharper picture of the rift agriculture. The eastern mountain ranges form a barrier between the rift and the eastern lowlands through which numerous rivers break and continue their turbulent course until they reach the plain and thence flow sluggishly in broad, shallow channels eastward to the sea.

The eastern coastal plain is wide except for its northern part. There, the narrow plain at Atjeh, with well-tilled plain is wide, although not uniformly so over its entire length. The coastal part is low, waterlogged, and generally swampy. As in Malaya, a mangrove belt separates the densely-forested coastal zone from the waters of the South China Sea. Harbors are rare except on islands, for example, Benkalis. The broad river outlets, if not closed by sandbars, afford easy access to the hinterland and a regular line of cities is located on the points where the swampy

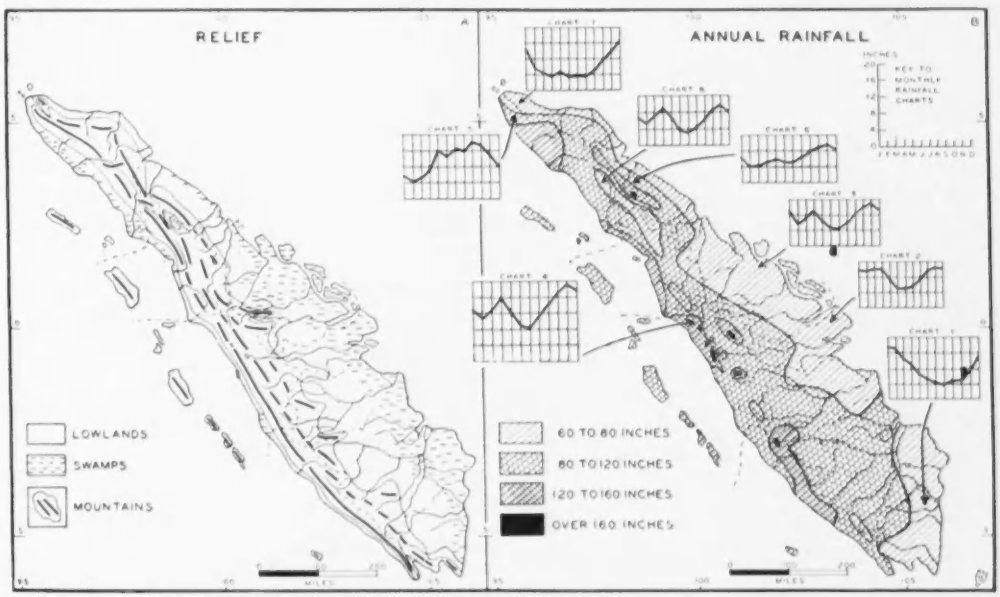

FIGURE 2.—A continuous mountain system forms the backbone of the island. Between the mountains and the west coast is only a narrow strip of lowland, but in the east the lowlands are extensive, and large rivers carry their muddy waters slowly towards the South China Sea. Precipitation is generally plentiful in Sumatra, but the distribution varies greatly with distance from the equator which almost bisects the island; while the amount of rainfall increases with elevation and with location on the windward side of the mountains.

rice fields and pepper gardens and relatively dense, prosperous population, widens southward and forms the famous estate region of Sumatra East Coast, to be discussed later in detail. Also in its most southern part, Lampongs, the plain narrows, and as in the north, rice fields show how intensive is the land utilization and pepper forms an important export crop. Here it is that colonization from Java has proved successful.

But except for these end regions the lowlands touch the higher parts of the plain and the ocean traffic shifts to riverboats. Three of these cities are shown on the map, namely, Rengat on the Kuantan River, Djambi on the Batang Hari, and Palembang on the Musi River. Of these three, only Palembang is really important. This city is located halfway between the fertile, well-populated mountain region and the coast. It is one of Sumatra's most ancient cities, once the capital of a strong political unit,

now the largest city of Sumatra. It stretches along the shores of the Musi with much of its life, economic as well as social, taking place on the river itself. From Palembang railways and motor car roads extend into the hinterland, making the town the trade focus of a large part of southern Sumatra. Coal and oil, both products of the older, folded structure of the higher part of the coastal plain, add industrial activity to the otherwise agricultural régime.

Though the low plains are almost uninhabited (settlements are only on the river levees exporting the forest products) the higher lands westward offer only limited agricultural possibilities, for while the slightly rolling country is better drained, the soils are generally leached and of low fertility. The milpa (ladang) type of land utilization still prevails here, while in the virgin forests still remaining, the primitive Kubu wander round in search for food. But the percentage of area in forest is declining rapidly because of the extensive burning of trees to make new ladangs and the consequent leaching of the exposed soil. The vigorous growth of tough grass (alang-alang) after the cropfield has been abandoned make a large part of it a monotonous savanna.

It is in this part of the coastal plain that one of the most astonishing agricultural events has taken place, namely the development of the native rubber production (see Figure 4A). Encouraged by government officials, the nomadic agricultural population began early in the twentieth century to plant young rubber trees on the ladangs, together with the dry paddy-crop. After the rice harvest the rubber trees kept on growing with the result that a kind of jungle developed in which rubber trees formed a majority. Nobody realized the potential possibilities of that rapidly growing rubber acreage till the rising rubber prices in 1923 and following years caused a rapidly increasing flow of native rubber out of Sumatra. In 1919 the production which had been in its day equivalent to 13,000 tons and had dropped in 1921—the year of low rubber prices—to 6,000 tons, increased tenfold in the next four years. Heavy profits were made not only by the Chinese merchants who bought the rubber in the area of tapping and shipped it on flat bottom steamers down the river for cleaning, but also by the natives themselves, who, never having seen money before, became rich overnight. The Sumatra jungle went rubber mad. A real rubber rush took place; only lack of labor limited the production as the trees were almost innumerable.

It thus forms an example of a crop introduced from the equatorial forests of South America and Africa and threatening to revert, although in a slightly different form and region, to the forest environment. Rubber is really not an estate crop in the true sense of the term. It is not limited, as are tea and coffee, to restricted suitable soils to produce a crop of high quality; rubber grows almost anywhere (except where soils are entirely leached or waterlogged) and processed rubber is a uniform product whatever its origin. The intensive production of rubber estates with their well planted highly producing rubber gardens and modern equipped factory can compete only with the greatest difficulty against the extensive jungle production. Then it does not matter if trees individually do not produce a great deal of latex or die because of overtapping; the number of trees and the low cost of the producing process more than balance the lack of intensive care. The native rubber, which for a time seemed to change the structure of rubber production entirely, and ruin the estates, declined in quantity, when after the breakdown of

the Stevenson restriction scheme, prices sank to a new low. Tapping was no longer profitable except in exceptionally favorable locations; the rubber jungle awaits another opportunity to startle the world once again with a flow of rubber. It seems at present that a kind of equilibrium has been reached between the native production and the estates, with their now greatly reduced price of production.

Under the new rubber restriction agreement the native rubber is also put

SUMATRA EAST COAST

The northern part of the province Sumatra—East Coast with its three subdivisions Deli-Serdang, Langkat, and Simelungan offers a perfect example of estate agriculture at its best (Figure 5).

The coastal plain between the Karo Mountains and the Strait of Malacca is the transition between the narrow plain of Atjeh and its wider expansion farther south. The coast is swampy as usual along the east shore of Sumatra. Tide

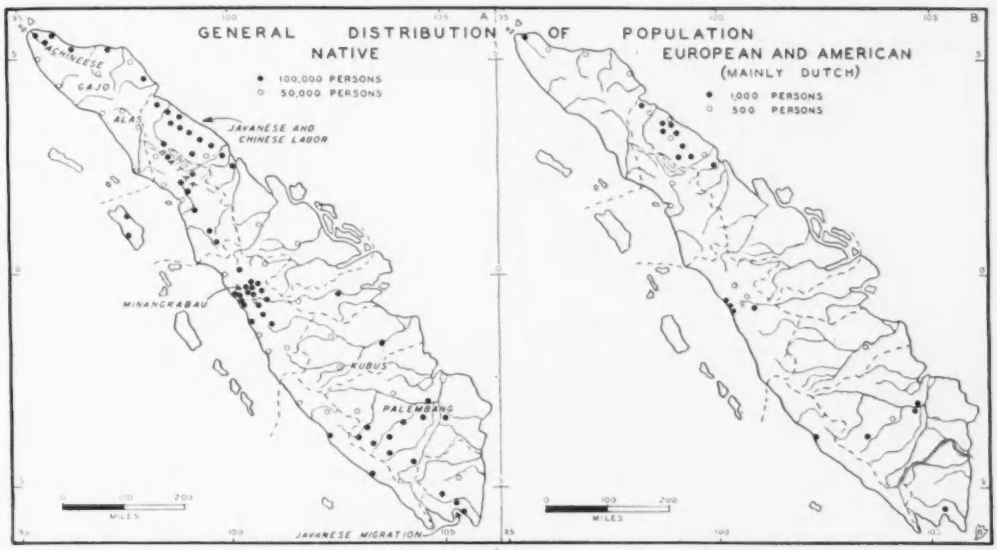

FIGURE 3.—Distribution of native population shows marked concentration in three sections: parts of the North East Coast, the hinterland of Padang, and the Musi region beyond Palembang. The white population is similarly distributed but the principal concentration in the area around Medan (Sumatra East Coast) reflects the great importance of that region for the world market.

under quota and is allowed two fifths of the total production of the Netherlands East Indies. Figure 4A shows the distribution of native rubber production (as well as estate rubber) for Sumatra in 1933. Only 60% of the total 160,000 tons came from Sumatra. West and South Borneo produced the rest.

Two parts of Sumatra will be given special description: one, Sumatra East Coast, for its economic significance; and the other the Padang Highlands, for its cultural standing.

water creeks run through a low forest of mangroves and nipah palms. The many comparatively short rivers do not offer access to the hinterland as in the southern plains, and the Malay influence remained localized in a few coastal settlements while the native Batak population used the forested plain between swamp and mountains for ladangs and the gathering of forest products. Pepper, as in Atjeh, was one of the major export products of this rather isolated part of Sumatra.

In this environment a Dutch merchant Nienhuys, started, in 1863–64, to raise tobacco, the beginning of a new era for this region. The gray and red soils derived from the volcanic Karo Mountains, proved of suitable structure and fertility and the cultivation of tobacco was successful from the first. Capital followed the pioneers. Forests were cleared, labor imported, harbor facilities arranged. The newly-established Sumatra tobacco industry devoted itself to quality, not quantity, and Sumatra most attractive tropical cities, showing what money can do to make life pleasant even in an equatorial environment. Railways and motor car roads extend in all directions while luxurious homes of estate managers, located amid model plantations, indicate the success of this type of land utilization, if not ruined by too low world market prices. Small centers sprang up, for example Kisaran the nucleus of American rubber interests. On the foothills of the Karo Mountains Pemetang-Siantar consti-

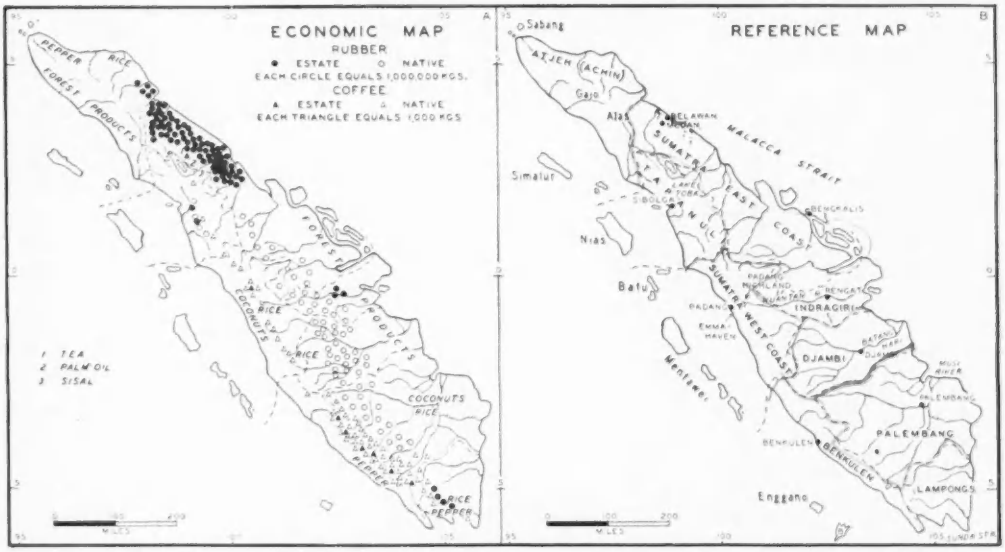

FIGURE 4.—Rubber and coffee are the two great commercial crops of Sumatra with a wide distribution. Coffee favors the slopes of the southern part of the mountain backbone, but rubber shows a dual arrangement; estate rubber in Sumatra East Coast (east of Lake Toba) and the native rubber on the higher parts of the extensive eastern coastal plain.

wrapper leaf obtained world fame. For a time tobacco remained the only crop; but starting in 1905 rubber also gained a foothold in the section and increased rapidly in importance. On the lower mountain slopes tea estates were established, followed later on by plantation of oil palms and sisal.

The result of the development is astonishing. Belawan, the other port of the main city Medan, is now equipped for large ocean steamers. Medan the center of the tobacco region is one of the tutes the center for the hill crops—palm oil, tea, and sisal. Even into the plain of northern Asahan isolated until recently, rubber estates have been established and motor car roads extend far southward.

The impressive Lake Toba, a product of faulting, with its perpendicular walls rising up to 3,000 feet above the water level has become a favorable place for recreation, easily accessible from Pematang-Siantar. On the wind-swept grass-covered plateau of the Karo, north

of Lake Toba, a regular tourist industry has arisen, based on the cool temperatures of a 5,000 foot elevation. The grass gives way to native fields of potatoes and vegetables to satisfy the demands of the plains inhabitants, whether they remain at home or come to the plateau for rest and recreation. So out of almost nothing grew one of the most productive agricultural spots of the Malay islands. Native agriculture followed the estates, although unable to feed the rapidly growing population which now amounts to one and one-half million of which 150,000 are Chinese, giving a density of 250 per square mile for the section Deli-Serdang.

Sumatra's white population (Figure 3B) also reveals here a marked concentration illustrative of the fact that the whole development has come into being through the import of white men's energy, and capital. Interesting also is the international participation in the different branches of estate agriculture, very different from any other region of this type. The following table gives the picture of the open door policy of the government to attract foreign capital:

FIGURE 5.—Out of the formerly unproductive wilderness of the Sumatra East Coast has risen the interesting development in estate agriculture which makes this section the most productive and valuable part of Sumatra.

TABLE II

1932	*Tobacco*	*Rubber*	*Tea*	*Palm Oil*	*Fiber*	*Total*
Dutch	100.250	143.927	27.118	53.572	40.000	364.867
British		105.374	13.938	3.738		123.050
American		74.854				74.854
Franco-Belgian	3.000	47.920		30.926		81.846
Japanese		9.478		2.515		11.933
Swiss	.750	3.508				4.258
German		3.660	3.198	3.405		10.263
Others		7.945				7.945
Total	104.000	396.666	44.254	94.156	40.000	679.078

Figures in millions of guilders.

Tobacco at present represents only one-fourth as much as the rubber investment and is nearly equaled by that in palm oil. The total investment is 270 million dollars (in predeflation values).

TOBACCO

The tobacco crop of Sumatra's east coast varies greatly according to the sales price. Each year the planted acreage is based on the demand of the world market. After one crop of tobacco, the field is planted with rice and then left fallow for many years. Hence of the total tobacco area of 700,000 acres, normally only 7% is planted each year. The large drying barns seem strangely exotic in the utmost monotony of alang-alang fields till their turn for use comes again. The value of the tobacco crop for an average year is about 60 million guilders; in recent years the operation has been at a loss.

RUBBER

In 1932 the acreage planted to estate rubber was 700,000 of which 63% was in production. The yield has been

fairly stable—between 72,000 and 92,000 tons, but is influenced by the market price and restriction agreements. Production of the American estates is not put on the market but is made directly for American consumption. Part of that export is in the form of liquid latex or as sprayed rubber.

TEA

The tea production centers about Pematang-Siantar. Approximately 55,000 acres are planted, of which 55% is productive. The total production in 1932 was 12,000 tons, being 1/6 of the production of the Netherlands East Indies and 3% of that of the world.

PALM OIL

The oil palm industry, only 15 years old, has made astonishing progress. It is not impossible that Sumatra's east coast will eventually achieve first world place for the product. Higher oil content and better oil extraction are advantages above the African Guinea coast, for many decades the uncontested monopolist. In 1932, 150,000 acres were planted, 62% was productive. The increase of production has been tenfold between 1922 and 1932. The following table compares Africa (where Nigeria is the main producer) and Sumatra:

WORLD EXPORTATION OF PALM OIL IN THOUSANDS OF METRIC TONS

	1925	*1926*	*1927*	*1928*	*1929*	*1930*	*1931*	*1932*	*1933*
Africa	194	178	176	188	206	216	193	189	202
N. E. I.	7	13	22	29	36	48	61	85	116
Malay	...	...	...	1	2	8	5	8	13
Share	3.5%	6.8%	11.1%	13.3%	15.2%	17.9%	22.5%	30.0%	35.0%

Palm kernels remain a minor product.

VEGETABLES

The truck-growing industry of the Karo plateau has been made possible by the temperate climate and the increasing demand of an accessible expanding market. Due to the government's help the growing of potatoes primarily and cabbage secondarily became a successful enterprise for the native farmer. The market has been extended even beyond Sumatra to Malaya and in 1920, 2298 tons of potatoes were exported from Belawan. Competition from Java and decline of soil fertility forced a period of stagnation, but in 1930 the total production of garden crops was 7,750 tons, to a value of two million guilders. Besides potatoes and cabbage, beets, endives, beans, and celery are raised in commercial quantities.

The vista of open plateau with fields of potatoes and vegetables, the Christian churches of the Batak population, and the European hotels with tennis courts and golf courses, is strangely unequatorial in its every aspect; yet in the neighboring mountain forests the tapir still roams wild, and elephant trails are in many places the only routes of transportation.

PADANG HIGHLANDS

Emmahaven, where the indented coast of volcanic rock offers natural harbor facilities is the outer port of Padang, the largest city on Sumatra west coast (Figure 4). The road from Padang to the highlands traverses a flat coastal plain entirely under cultivation—well-irrigated rice fields surround the numerous villages, and tall coconut trees sway over sluggish brown streams. After heavy rains, which fall frequently, most of the plain is flooded and bridges may be carried away by temporary torrents. From this plain the narrow gorge of the Aneh River opens inland. The steep, forested walls, a cross section through the Bukit Barisan, rise precipitously on both

FIGURE 6.—The Padang Highlands, bordered by high volcanoes, once almost isolated from the rest of the Malay world, comprise a densely populated, highly productive upland where Malay culture has reached the peak of its achievement.

sides, leaving scarcely space for the winding road and railway. Rather abruptly the valley widens and opens to the Padang Highlands. Southwards the lovely Lake of Singkarak fills a depression of the rift and its beauty suggests the Italian lakes. Northwards a saddle between the majestic volcanic cone of the Merapi and the twin volcano Tandjikat-Singgalang widens into the high plateau of Fort de Kock, a basin filled with volcanic material in which the rivers have eroded veritable gorges, with perpendicular walls of volcanic tuff.

Here, and in its eastern extension, the plain of Pajakombo forms the very heart of Malay culture, the Minangkabau. Dyked rice fields cover the plateau and mount up the terraced slopes to the climatic limit of growth. About the mosques with their tall slender minarets stand the richly ornamented and brilliantly colored homes in gardens of fruit trees. The elevation (2,000 feet) is too great for coconuts, but otherwise the richness of fruit variety is astounding. The roads are crowded with passers-by; gray, thick-skinned buffalo move slowly in front of wagons laden with paddy; pony-carts speed along among tooting motor cars trying to find their way through the traffic. On the market square women in beautifully colored sarongs offer local produce for sale, while tall, well-built men ride horseback home from their fields. All about rise mountains, mantled in the silence of dense forest; but here on the plateau is the light and the colorfulness of happy homes. The Minangkabau displays a cultural development unrivaled by any other equatorial region of the world.

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HOW BIG IS JAPAN?

A. E. Parkins

MOST readers recall that Japan signed the New Consortium in 1919 and the Nine Power Treaty formulated at the Washington Conference in 1921–22, both designed to protect the sovereignty of China; the Kellogg-Briand pact and the Covenant of the League of Nations, both of which provide for the settlement of international differences by peaceful means. They have not forgotten Japan's slow absorption of Korea; the Twenty-one Demands on China; the Shanghai Invasion; the setting up of the Japanese-controlled kingdom of Manchoukuo; the annexation of Jehol to Manchoukuo; the invasion of northern China and the defiance of the League of Nations; or Japan's declaration that she would fight to retain the mandated islands of the North Pacific; the announcement in 1932 of her withdrawal from the League of Nations; and the declaration in 1934 of a Japanese protectorate over the entire area of eastern Asia, including British India and the Dutch and British East Indies and French Indo-China; the declaration that she would oppose "any attempt on the part of China to avail herself of the influence of any other country in order to resist Japan"; and, lastly, the abrogation of the naval ratio agreement of the Washington Conference. These are official and semi-official activities and announcements—the major high lights in the case of Japan versus the civilized world. Today Japan stands practically without an intimate friend among the nations, except possibly Germany.

There have been in recent months unofficial, or "Tokio inspired," declarations of the near approach to wars with Russia, Great Britain, and the United States. The *casi belli* are various. The Chinese Eastern Railway, the Stimson doctrine, Soviet forces in eastern Asia, Britain's stand in the cotton trade war in India, American and British objections to the oil monopoly of Manchoukuo, the sale of American airplanes in China, League assistance to China, the Lytton Commission, and other "affairs" have stirred the ire of the Japanese against these countries, and many Nipponese no doubt have announced, as does the Mikado in Gilbert and Sullivan's opera, "I've got them on my list, I've got them on my list." Russia, Britain, and the United States will need to practice patience and tact if war in the Far East is to be avoided.

The world has recognized Japan as one of the great nations. She has participated actively in world conferences and is a member of the League Council. Apparently she considers herself one of the *big* powers. But how big is Japan? Using the cold facts of statistics, how does she compare in productive power, in resources, and in the ability to withstand a protracted war with a great power?

Japan has a well-trained, active army of 260,000 men (in 1931–32) and an immense number of trained reserves. Service in the army and navy is universal and compulsory. Liability for service begins at the age of 17 years and ends at 40. In late years naval construction in Japan has not lagged as in the United States. Instead of the tonnage ratio for Britain, the United States, and Japan being 5, 5, 3 as called for in the treaty, in 1932 it was 11, 10, and 7.5. One seemingly reliable report gives the

air forces of these three countries, based on the number of planes in 1931, as 1630, 2367, and 1639, respectively. In both land and air forces Japan falls behind Russia. The Hermit Kingdom has fought two successful wars—with China and Russia. Modern Japan's forces have been able to uphold the Samurain tradition; yet in 1931–32 the poorly equipped Nineteenth Route Army of China at Shanghai surprised the world at the resistance it offered to the crack companies of Japanese soldiers. In fact, Japan has yet to test the effectiveness of her military machine in combat with a first-rate power.

The writer is here proposing to measure fighting strength not on the basis of number of regiments, naval vessels, and airplanes but on quantity of resources being exploited and on financial reserves. An expert for one of our large munition manufacturers has recently said, "Any nation that sets out to win a war, will win." Japanese morale, "the will to win," is now at high tide and such spirit may perform wonders, but after all *spirit* needs a material basis. Careful training, equipment, and huge reserves of war materials will suffice for a time but, in a protracted war, resources and the ability to turn these resources into consumable goods will be the deciding factors. We will make a comparative study by graphs of the four nations so frequently mentioned of late in Far Eastern affairs.

Under the term Britain, in the graphs, are included Great Britain and North Ireland, Canada, South Africa, Australia, and New Zealand. These would certainly form a united front in case of a war with Japan. India and South Ireland are not included nor are the lesser political units of the British Empire. The data for Russia cover Russia in both Europe and Asia, that is, the U. S. S. R. The data for the United States cover continental United States. Japan includes Japan proper, Korea, and Formosa.

In point of population Japan ranks among the five or six great nations. Graph I reveals its rank with the three other great nations under consideration. A large population is an advantage when large numbers of fighting men and economic workers are desired and the opportunities for producing food are abundant but a large population in a country of limited area and limited food resources may prove a serious menace.

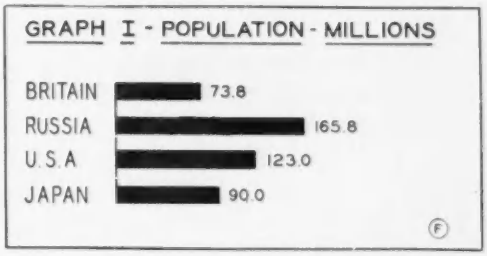

FIGURE 1.—In point of population Japan ranks among the five or six great nations. Its rank with Britain, Russia, and the U. S. A. is here revealed.

In Graph II are considered the area now cultivated in each of the respective countries and the total cereal crops. The cereals include wheat, oats, barley, rye, corn, and rice. These have all been "lumped" together. Wheat is the major food crop of the Western Powers, rice of Japan. All, however, in emergency could be used in some form. As for the staple food crop of each of these countries, Japan produces 421,000,000 bushels of rice; the wheat crops of the other three nations are: the United States, 744,000,000 bushels, Russia, 744,000,000 bushels, and Britain 720,000,000 bushels (1932–33).

The low rank of Japan in both the area of cultivated land and cereal food production is certainly striking. The only food crops not listed above that are produced within the realm are soya beans, potatoes, and sugar beets. The

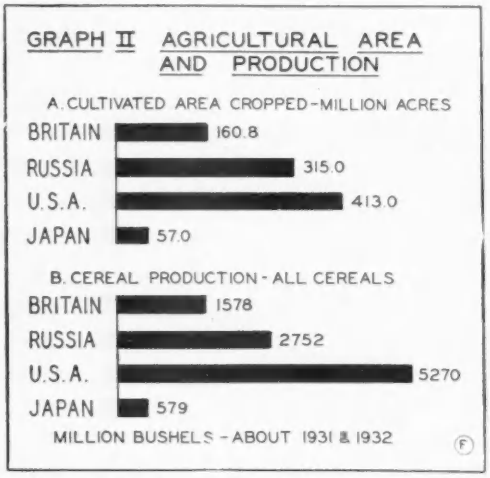

FIGURE 2.—Area now cultivated in each of the respective countries, and the total cereal crops, reveals the relatively difficult position Japan holds among the nations that compete with her.

soya bean crop is about 40 per cent of the wheat crop by weight, but the wheat crop of Japan equals only about 4.5 per cent of the wheat crop of the United States.

Should Japan be able to keep open a "bread line" to Manchuria (Manchoukuo) she would find there from 31,000,000 to 33,000,000 patient farmer folk, 98 per cent of whom are Chinese and Mongols (the total population is estimated to be about 34,000,000; figures are estimates for the most part) that might supply her with a large portion (their surpluses) of the 1.5 million tons (50 million bushels) of wheat raised yearly, the 3.7 million tons of millet, the 7 million tons of soya beans, and the 5 million tons of kaoliang (a grain sorghum). Yet this supply would not put Japan on a parity with the other nations in food production ability. The cultivated area of Manchoukuo is only 38 million acres. This, added to the 57 millions of acres of Japan, is less than a third of the cultivated area of Russia and less than a fourth of the cultivated area of the United States. China, even if she were willing to supply foods to her island neighbor which has never lost an opportunity to exploit her, would have little to spare, for it, too, has a dense population. It is the thinly-peopled regions of the world like Manchoukuo that have surpluses for export.

The potato, a staple food in Europe and America and one capable of yielding immense returns, is little raised in Japan. In 1932–33 the Russians raised 1,470 million bushels, the Americans 358 million bushels, and the Japanese but 30.4 million bushels.

As for sugar, Japan's lone sources are Japan proper (for beets) and Formosa (cane). Large quantities are imported. Rice, wheat, beans, and sugar, all are imported in large quantities.

In one food product the Japanese probably lead all peoples. It is not strange that an island kingdom in the Temperate Zone with large areas of shallow salt water available, and limited areas of farm land, should turn to the sea for food. The fisheries of Japan are probably the most productive in the world. Today they employ about 780,000 permanent fishermen and nearly as many occasional fishermen, in comparison with 60,000 in Britain which is considered among the more active fishing nations of Europe. There is no way of even estimating the extent to which the fish of Japan compensate for the scarcity of cereal foods or meats.

The relative shortage of Japan in cereal foods is all the more serious for the welfare of the nation because the people are not meat eaters. Cereals and beans form a large part of the diet. People of the more densely settled countries are predominantly vegetarians. Their economy will not permit them to waste their valuable land to grow vegetable foods to feed animals which produce only a sixth to a tenth as much nutriment as vegetable food on the same area. The advantage the other three major nations have over Japan in animal

food resources, by being meat eaters, is plainly evident when one compares the relative numbers of live stock, shown in Graph III, of these four nations.

The industrial activity of no other nation today has received the publicity as has that of Japan. The world was astonished to hear that in 1933 Japan produced more yardage of cotton cloth than Britain with a textile equipment not more than a sixth of the installed machinery of the country that for more than a century and a half has led the world. Cheap, hard-pressed labor, a debased currency, government-encouraged industries, and government-stimulated marketing activities have put Japanese goods in the markets of every country on the globe that has overseas transportation facilities with Japan. American "five- and ten-cent" stores are flooded with goods "Made in Japan." The Swiss, the French, the Italians and many other European peoples that are producers of light manufactures are all feeling the pressure of Japanese competition. Japan's greatest advance in capturing markets has probably been in the Middle East. The Dutch colonies in the East Indies, the Philippines, Australia, New Zealand, and other regions, even eastern Africa, find Japanese goods cheaper than those offered by European and American firms. Yet a comparative study of the statistics of manufactures of the several countries for 1933 clearly shows that Japan holds only a low rank. By attacking wholly unawares the world markets on many fronts and by offering goods at prices far below those in Occidental countries, Japan has thrown a scare into many markets. The value of her goods in any one country is after all very small. The conspicuousness of the articles is due to their recency of arrival. In fact, in 1932 the total value of Japan's exports was only about $396,000,000 as compared to $1,611,000,000 for the United States (*Foreign Commerce Yearbook*, 1934).

Graph IV presents data of significant items from which one may judge the relative producing power in manufacturing of the four nations being compared. Even the casual reader can readily realize the dire significance of Japan's rank in coal production, oil production, water power development, pig iron and copper production. Her rank in iron and copper, two very essential minerals in either peace or war, is low. She holds a low rank in all forms of power, except man power. T. T. Read has calculated that the daily output of work in millions of horse power hours for the United States is 1,643, for Britain 317, and for Japan 110. This includes mechanical, animal, and human power (*American Economic Review*, March, 1933). Again we see the low rank of Japan.

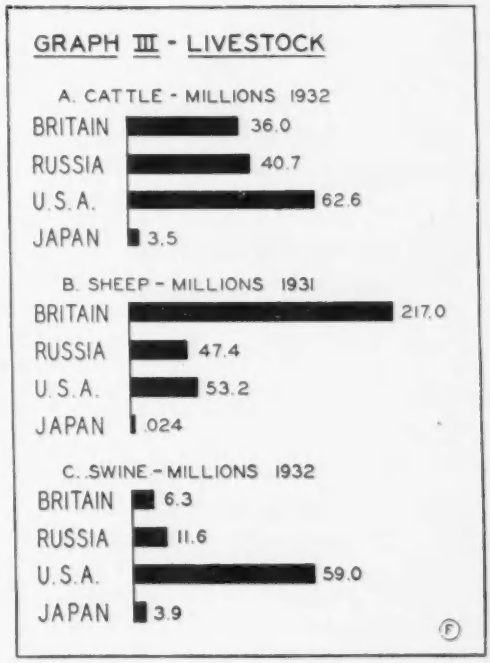

FIGURE 3.—The advantage the other three major nations have over Japan in animal food resources, by being meat eaters, is plainly evident when one compares the relative numbers of livestock of these four nations.

To supply her textile mills, Japan must import nearly all of the raw cotton consumed, less than 147,000 bales being grown within the empire. Compare this with the 13,200,000 bales produced in the United States in 1933–34 (17,000,000 bales in 1931–32), and the 1,800,000 bales produced in Russia. Raw cotton constitutes the largest item in the imports of Japan. As for wool, Britain produced 1,500 million pounds in 1932, Russia, 140 million pounds, the quantities to meet her needs and in a prolonged war she is certain to run short. The chief Asiatic sources are the Dutch East Indies (5.5 million barrels), Persia (7 million barrels), and the island of Saghalin (the oil wells are in Russian Saghalin, but are leased to a Japanese company), the production figures for which are not available. The crude oil resources in Japan proper are about exhausted (*The Japan Yearbook,* 1931).

To supplement her meager supplies

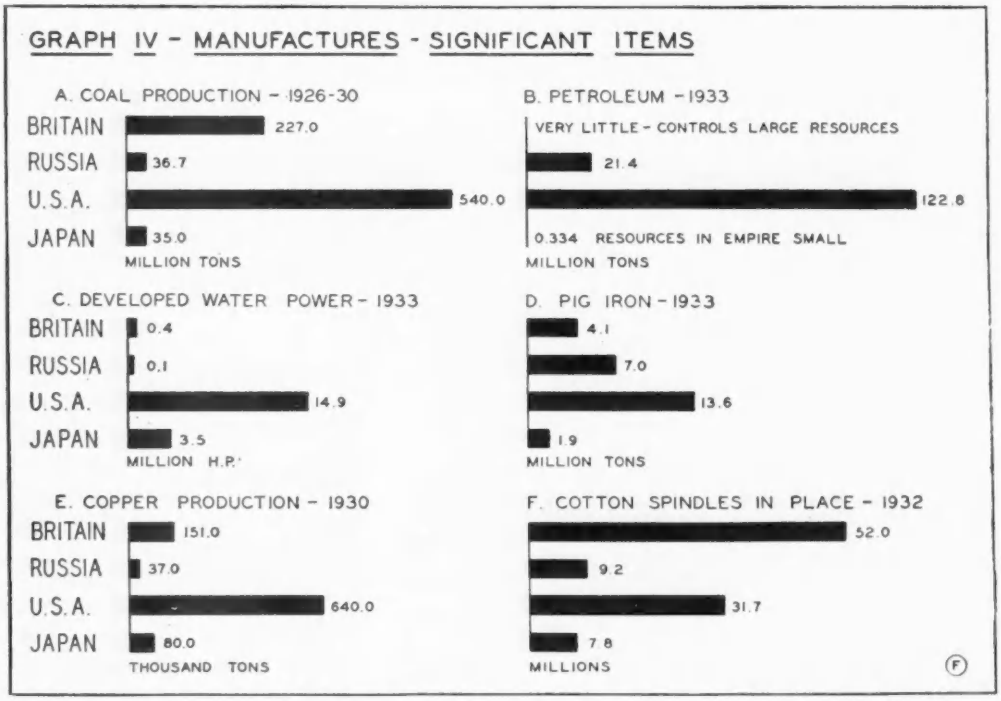

FIGURE 4.—Significant items in the relative producing power in manufacturing of Britain, Russia, United States, and Japan.

United States, 429 million, and Japan, practically none. Wool and woolen yarn form the second large item in Japan's imports. Under such conditions, if all imports were shut off, Japan, in a few years, would be a silk clad or a nudist nation.

Huge quantities of petroleum are essential for effective military operation in modern warfare (See Graph IV). Japan will need to store up immense

of many of the essential resources needed in manufacturing Japan can call upon Manchoukuo and China. Iron ore is in abundance in both these countries. There are oil shale, lead, silver, and gold in Manchoukuo and copper, tin, antimony, oil, and coal in China. The iron ore of Manchoukuo is of poor grade, however, so poor that Japan can purchase pig iron from India at a lower figure than she can from Manchoukuo.

More careful scrutiny of the mineral resources of Manchoukuo reveals that their importance has been grossly exaggerated.

Japan has a free hand in Manchoukuo. However, if Chinese sentiment remains as it now is, aggressive movements into China would only increase the number of Japan's enemies. And even though Manchoukuo is Japan's puppet, possibility exists that 33,000,000, or more, Chinese, Mongols, and Koreans in that country, formerly a Chinese province, may prefer to rejoin China or to set up a new Chinese-controlled state than to continue to be dominated by Japan.

Feudal Japan was largely agricultural. The farmers worked their small plots of ground (three-fifths of the arable area is in holdings of about an acre) most intensively. The westernizing of Japan had little effect on agriculture because the individual farmers lacked the capital to purchase the machinery that has so multiplied the productive power of the farmers of the Occident. Japanese agriculture is still feudal in methods. Though the returns per acre are large the returns per worker are small. It is in manufactures that westernization has wrought the greatest changes. Most of the Japanese factories are as well-equipped as those of Europe or America. Most of the textile mills have automatic machinery, largely purchased in America. Therefore, with cheap labor Japan produces goods far cheaper than can Occidental countries. The limited resources of power and the lack of raw material within Japan are, however, restrictive factors.

The maritime nations of the West seem to fear competition from the Japanese merchant marine. In periods of depression, when the ports the world over hold a surplus of idle ships, a nation that can operate its ocean carriers with low price labor with a crew on each vessel numbering far less than is permitted on the ships of its competitors, can greatly worry competing mercantile countries. Japan has a network of steamer lines now covering the commercial world and new lines are contemplated, yet the total tonnage of her merchant fleet is relatively small. The tonnage of the merchant vessels of the four powers in 1932 was as follows:

United Kingdom	10,538,000 tons
Russia	Very small
United States	3,946,000 "
Japan	1,964,000 "

(Data from *Foreign Commerce Yearbook*, 1934.)

Three more comparisons are attemped in this study in graphics. These concern national wealth, gold reserves (in central banks and government vaults), and gold production, shown in Graph V, on all of which depend the financial stability of a country in periods of turmoil. In these three items as with the other items compared, Japan is the least of the nations.

Can any one who has followed through these brief comparisons see how Japan could long remain an effective fighting power? Can Japan afford to enter into a naval building race with the United States or Britain or both combined?

The Western Powers have no designs on the national integrity of Japan. They can also protect themselves, in time, from the invasion of cheap goods by erecting tariff barriers. Already a distinct decline in foreign sales of Japanese goods reveals itself. The boom in Japan may be on the wane. They will hardly acquiesce to Japan's Far East Monroe Doctrine if under this doctrine that country attempts to enforce her announced plan to interfere with the coming and going of the commercial ships and goods of these powers, and to dictate as to the kind of commodities these powers may or may not sell in China or Manchuria. The United States at

least, wants to make the Open Door Policy a reality. These nations may sometime tire of Japan's "big talk."

It is in Japan's dealings with Western Powers in the past and her own state of mind that one finds the explanation of her behavior. There is, as her spokesmen have announced frequently, a determination to have equality with other nations. She has never forgotten the insult to her national dignity when in 1895, at the close of the Sino-Japanese War, France, Germany, and Russia—"The Unholy Three," to Japan—forced her to restore to China the Liaotung Peninsula which she had secured by reason of her victory. During the next ten years Russian imperialism exacted far more concessions from China than the Japanese had.

Her active participation in the councils of the Great Powers has helped in some degree no doubt to atone for this slight. Desire for racial equality, however, has not yet been satisfied. She has not forgotten the refusal of Wilson at Versailles to permit the inclusion of a clause on racial equality in the treaty, the decision of the United States Supreme Court in 1922 that Japanese are not eligible to American citizenship, the Anti-alien Land Law decision in 1923, and the insult the American Congress dealt her when it passed the wholly unnecessary Japanese Exclusion Act in 1924, unnecessary if the aim of the immigration laws is to maintain a dominance of North European blood in our citizenry. The Japanese quota would be infinitesimal as the quota is now based. Her state of mind is such that she sees insult to her racial feelings even when none is intended.

Necessity is another motivating factor in Japanese behavior. Sixty-five million people in Japan proper on a cultivated area equal (about) to the cultivated area of Iowa (with 2,500,000 people) is a challenge to the Japanese bread providers today. Industrialization and associated commerce and shipping have helped to a certain degree to relieve the pressure of population. Migration has been considered but the Japanese to date have not gone pioneering. Only about 115,000 Japanese live in Manchoukuo as compared to from 31,000,000 to 33,000,000 Chinese. The Japanese seem to lack the experience, or ability, to adjust themselves to new environments. The much heralded attempts at the colonizing of Manchoukuo are failures. To make matters worse, Dame Fecundity is a busy body in Japan. Large families are encouraged by the state. The annual increase in population—births over deaths—is now about 1,000,000. In ten years Japan (including Korea and Formosa) will have more than 100,000,000 people. A country so dependent on foreign lands for foods, commercial raw materials, and markets, and as densely peopled as Japan, is a perpetual threat to world peace, if that country is at all militaristic and aggressive. Adversities, natural or human, may lead to grave consequences. By peaceful means Japan can secure most of the raw materials that are necessary to supplement her meagre home supplies from near-by lands and her manufactured goods can find active markets in many foreign lands through reciprocal trade agreements were they fabricated under labor conditions that prevail in western countries. Instead, alleged banditry is the excuse for military operations in territory the markets of which she covets. Britain long ago learned that she could win and retain markets by peaceful means more effectively and easily than by a show of force. Japan has this lesson yet to learn. Her leaders are thinking in terms of the mercantile system of the sixteenth to eighteenth centuries—exclusive markets. Her

methods of territorial expansion are those that were in vogue in the centuries preceding the twentieth.

When world opinion accuses Japan of unwarranted encroachment upon the sovereignty of China she points an accusing finger to America's acquisition of Texas, California, Porto Rico, the Philippines, and the Canal Zone, and to British aggression in Egypt, Anglo-Egyptian Sudan, Western Sudan, South Africa, Arabia, India, and elsewhere. Her leaders fail to recognize the trends in present-day commercial imperialism.

Territorial security is a third desire of Japan, as it is of any nation, but many events and her interpretation of these events lead her to question the certainty of security. The refusal of the nations to recognize her creation of Manchoukuo, her increasing isolation in the world's family of nations, the apparent (to Japan) "approachment" of the United States and Russia, the United States and Britain, and Britain and the Netherlands and even the coldness of France and Italy must all be a bit disturbing to her peace of mind. She harbors hallucinations. Almost any move the United States makes in or on the borders of the Pacific—naval maneuvers, airplane try-outs, airplane base in Alaska, a Nicaraguan canal—that Britain makes in the Middle East, or Russia, in Eastern Siberia, Japan interprets as a threat to her security. The War Office of Japan has recently issued a brochure which attempts to show that Japan is surrounded by enemies which, having isolated her at Geneva, are now encouraging an anti-Japanese movement in China and are blocking Japanese commercial expansion through tariff and quotas (*New York Times*). Do such hallucinations come from a consciousness of her numerous violations of international ethics, agreements, and laws?

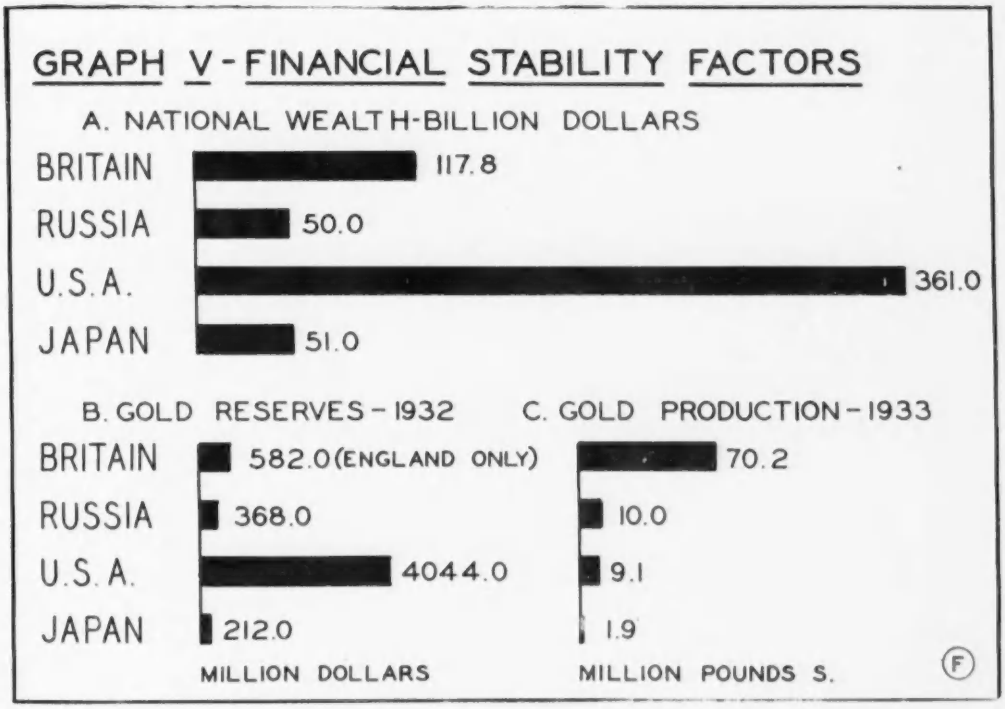

Figure 5.—Comparison of national wealth, gold reserves (in central banks and government vaults), and gold production. On all of these depend the financial stability of a country in periods of turmoil.

Japan's leaders must wonder how long the nations, which have vast commercial interests in the Far East and Middle East will forego action to check her attempts at exclusive commercial domination. If war should come with any one of the nations considered in this graphic study —even a combination is possible and even likely—one can readily predict the outcome.

Certainly the Western World hopes that the reign of the militarists of Japan will soon be replaced from civil circles by wiser counsellors of the Emperor.

A NEW MAP OF THE DAIRY AREAS OF THE UNITED STATES

Richard Hartshorne

THE principal map of this article (Fig. 1) is designed to show both the relative and absolute importance of dairying in the different parts of the United States. The relative importance is measured in terms of milk production in proportion to the cropland (after the manner developed by Wellington Jones, in "Ratios and Isopleth Maps in Regional Investigation of Agricultural Land Occupance," *Annals Asso. Amer. Geog.*, 1930, pp. 177–195). The absolute importance is shown by isopleths based on the ratio of milk production to the total land area. The relative importance, which indicates the character of whatever farming is carried on, is shown by the nature and direction of the lines on the map; the absolute importance, a measure of intensity of dairy production regardless of farm systems, by the density of the shading.

Detailed study of farm types in many counties scattered over the country indicates that dairy production is the dominant feature of the farm system, measured both by land use, and by value of products sold, where the milk production is greater than 70 gallons per acre of cropland. Where this ratio is between 50 and 70, dairying is probably the most important of several important branches of farming, including meat and cash-grain production; a ratio of 30–50 indicates that dairying is probably less important than other phases of farm production, but there is some surplus of dairy products sold from the farms. Where the ratio is below 30 dairying is of minor commercial importance.

If the value of the products is made the criterion, certain important exceptions are found, namely, in districts of intensive production of high-value products, such as tobacco, fruits, potatoes, vegetables, or poultry and eggs. (Of districts having a relative ratio of 70 gallons or higher only, the following have products greater in value than the dairy products: market garden districts around New York, Boston, and San Francisco; poultry districts in southeastern New Hampshire and the Puget Sound lowlands of Washington; tobacco in the Connecticut Valley, and a part of the Blue Grass; potatoes in northern Wisconsin, and fruit in a few California counties.) In these districts however the greater part of the farmers' land may be used for the dairy cattle, even though less of his labor and income are concerned. On the more efficiently operated tobacco farms, as in the Kentucky Bluegrass, and notably Lancaster County, Pennsylvania, dairy as well as beef cattle are used to fertilize the tobacco fields.

The absolute amount of milk production reflects of course not only the degree of productivity of the area concerned, but also the relative importance of dairying in the general farming. Thus the rough uplands of southern New England show the same absolute milk production as the fertile plains of the Corn Belt because the New England farms are predominantly dairy farms, whereas those of the Corn Belt are predominantly meat farms, with minor dairy production.

It seems desirable to omit from the map isolated districts with very low actual production (under one half million

gallons) even though the ratio of relative production might be very high, even infinite. For if there is almost no cropland whatever, but a few dairy cattle are fed in barns or graze near the ranch, as in the semi-arid areas of the southwest, or graze in the cut-over sandy pine-lands of the South Atlantic and Gulf Coasts, the proportion of milk production to cropland is very high, even though there is in fact almost no dairy production.

Another measure of the relative importance of dairy production is shown by the production of milk per capita of farm population (Map 2). The steady decrease from north to south is the most general feature of the map; southern California is a striking exception. The distinctively dairy areas are set off by the isopleth of 1000 gallons per farm capita. As the average for the country is about 360 gallons, all areas included by the 500-isopleth have a considerable surplus of dairy products from farms, those south of the 100-isopleth (drawn only approximately) have on the whole very little dairying. However, since the average annual consumption of dairy products in the United States is the equivalent of but 87 gallons of milk per capita it follows that the farms in all areas of the country, with the possible exception of the southeast, produce a surplus of milk products for local towns. Even in the southeast, where per capita production falls below the average consumption for the country, the very low consumption by the negro and poor-white farm population may leave a surplus for urban sale.

On the third map is indicated whether the dairy production is primarily for butter or for whole milk, based on the value of the products sold from the farm. Unfortunately the census provides no basis for separating milk sold for household purposes and that sold to cheese factories and condenseries or canneries.

THE DAIRY AREAS

The main area of dairy farming extends in a not quite continuous belt across the northern part of the humid eastern half of the United States, from the Atlantic Coast to central Minnesota. This belt is broken, in central Michigan and in the Ontario peninsula, into the two most important dairy regions of the country: the northeastern region centering in New York and western New England, with important extensions to the south; and the Upper Lakes region of Wisconsin and eastern Minnesota. A third main region, completely separated from these, is found on the Pacific Coast extending from the Canadian boundary south into central California. Beyond these are minor surplus areas in the Ohio Valley, parts of the southern Appalachians and Ozarks, and in irrigation districts of the inter-montane states. In the other districts shown on the map dairying is carried on largely to supply fresh milk to local cities. In certain areas that hardly appear on the main map because of the predominant importance of other farm activities—in the corn-wheat-meat belt, in the commercial wheat regions, and in the grazing areas—dairying is present as a minor branch of the farm system producing not only for local consumption but even a considerable surplus, sold chiefly as butter fat.

The North Central Region. The western part of the main dairy belt is relatively simple in its regional structure. In general it shows the greatest degree of specialization in dairying and the larger part of the area produces butter and cheese for outside markets, rather than fresh milk for local cities. The greater part of the area is included in the hay-and-pasture belt—rough moraine plains north of the limit of corn-for-grain, in which hay-and-pasture occupy more land than crops. On the south it

extends into the region where corn matures and is the major crop, in two types of area. In the rough hill land of the unglaciated district at the corner of Wisconsin, Iowa, Minnesota, and Illinois, the large amount of land in slopes usable only for pasture or hay causes dairy cattle to be more important than beef cattle, and butter is the chief commercial product. Immediately southeast of this district conditions are reversed. While the fertile level plain on both sides of the Illinois-Wisconsin line could be used for the more intensive corn-meat farm system of the Corn Belt the proximity to the Chicago-Milwaukee urban area causes it to be specialized in dairying though that requires more land to be in hay and pasture, i.e., less productive in actual yield, though of course more in ultimate money value.

The outer limits (isopleth of 50 gallons, relative) of this region enclose the greater part of Michigan and Minnesota with all of Wisconsin, and small parts of Iowa and Illinois. The most specialized section (over 70 gallons, relative) include eastern Minnesota and northern Illinois with practically all of Wisconsin. The lesser development of dairying in the southern peninsula of Michigan in comparison with Wisconsin is probably due to other than physical factors, though in certain areas in Michigan the predominance of sandy soils in certain areas is no doubt significant. Certainly the "hole" in the dairy area in central Wisconsin is an area of glacial sands (Adams County, etc.) in which rye and potatoes are major cash crops.

In terms of absolute production this region includes the largest continuous area of high productivity (over 30 gallons per acre of all land) in the country. This includes almost the whole of that section of the region lying west of Lake Michigan and south of a line running west from Green Bay. The sandy area

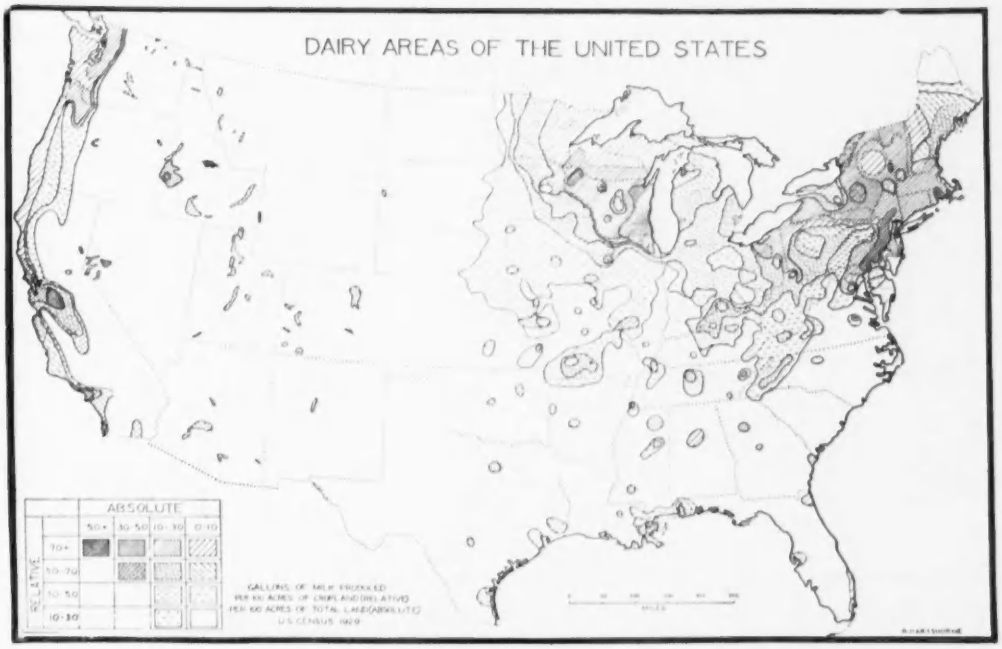

Figure 1.—Relative and absolute importance of dairying in the United States. The relative importance, in proportion to cropland, is indicated by the character and direction of the lines, the absolute importance, or intensity, by the shading. (Based on the U. S. Census for 1929, by counties.)

of Adams County is of course the major exception again. On the north the productivity drops off fairly rapidly and the northern parts of Minnesota, Wisconsin, almost all of the northern peninsula, and the northern end of the southern peninsula, of Michigan, are much more largely forest and cut-over areas with little farming of any kind.

The area includes several districts of very high productivity (over 50 gallons absolute). The southeastern quarter of Wisconsin with the adjacent area in Illinois is the largest district of very high intensity of dairy production in the country. A part of this is in the Chicago-Milwaukee fresh milk territory. Several smaller districts are located in the butter-producing area in western Wisconsin, and Minnesota.

In south central Michigan (and in the Ontario Peninsula, not shown on the map) dairying is a minor element in a highly diversified farm system in which wheat, rye, field beans, and sugar beets are important cash crops. Southeastern Michigan however is concerned with milk production for Detroit. South of this, including the southern strip of Michigan and extending east to the foothills of the Appalachians in Ohio, is the region of corn-wheat-and-meat farming in which dairying is important chiefly for local farm and city supply. The "holes," on the main map, in Ohio are less urbanized districts.

The Northeastern Region. That dairying is either the leading or the dominant farm activity throughout most of the New England and Middle Atlantic region is of course a result in part of the high degree of urbanization of that area, but is also an adjustment to the rough hill country of the Appalachian plateau and the New York-New England highlands. By contrast, the farms in the level fertile lands of the Ontario Plain in New York and the valleys of the ridge and valley country from Pennsylvania to Virginia, are notably more diversified, producing wheat, meat, and locally fruits and vegetables, with dairy production distinctly minor. In the eastern part of the ridge and valley section and the adjacent Piedmont there is a wide prong extending from the Hudson to the Potomac in which the great number of cities, large and small, has caused farms, even on fertile land of "Corn Belt climate," to specialize on dairying. (The special case of the tobacco beef-and-dairy farms of Lancaster County, Pennsylvania has already been noted.) Immediately east of this belt however in the sandy coastal plain from Long Island to Chesapeake Bay there is little or no dairying. Though corn, as well as wheat and other grains, are raised here, apparently hay and pasture are too poor for dairy cattle. On the other hand the dairy industry in the St. Lawrence and Champlain lowlands of northern New York, Vermont (and adjacent Canada) antedates the extension of the fresh milk territory of New York, Boston, etc., into this area, formerly a great cheese and butter producing region. That the contrast between this district and the Ontario Plain can be explained entirely on a climatic difference hardly appears likely; probably more intimate knowledge of the areas is needed.

If attention is concentrated on the areas dominantly dairying, i.e., over 70 gallons per acre of cropland, the exclusion of almost all of the state of Maine is striking, but the explanation is not clear. Most of the region south of a line through New York and Cleveland is likewise excluded on this basis. Here it may be because the ability to mature corn encourages more meat production, and, as already indicated, in eastern Pennsylvania and Maryland wheat is important. Only the narrow belt close

to the zone of cities from New York to Baltimore is specialized in dairying. Quite opposite conditions underlie the situation in the Alleghany plateau in western Pennsylvania and adjacent Ohio and West Virginia. Excepting for the narrow area of highly developed coal-mining and steel manufacturing extending from the Monongahela Valley in West Virginia through Pittsburgh to Youngstown and Cleveland, this is an area where rough land and poor roads make many farms economically remote and hence more subsistence, therefore necessarily more diversified, in character. The extreme of this is found in a large area in western Pennsylvania which lies between main rail routes passing north and south of it. Northern Maine is probably also somewhat isolated and, where farming is possible at all, more concerned with potato production, in part perhaps, because of sandy soil.

In absolute intensity of milk production three areas of high productivity (over 30 gallons per acre of total land) can be recognized: the St. Lawrence and Champlain Lowlands in northern New York and Vermont; the more moderate uplands of western and southern New York surrounding the Ontario Plain and overlapping slightly into Pennsylvania; and the Piedmont and Great Valley "tongue" extending through eastern Pennsylvania and adjacent states, from the Hudson to central Maryland. (Dense farm population in the latter district reduces the surplus available for sale.) In the richer portions of the first two of these areas are districts of very high intensity of production, over 50 gallons per acre of all land. That this figure is reached in no

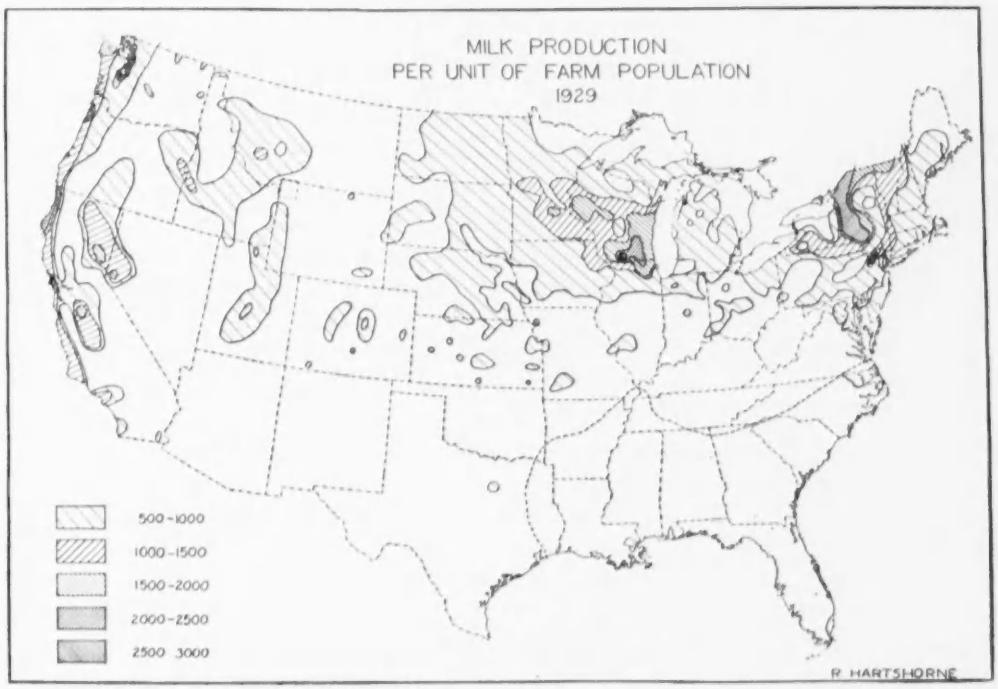

Figure 2.—Gallons of milk produced per year per capita of farm population. Blank areas produced less than 500 gallons. The broken line in the south represents the approximate boundary of the region in which, in general, the production was less than 100 gallons per farm person. (Based on the U. S. Census for 1929, by counties.)

county in the Piedmont-Great Valley area is because that region is not so highly specialized in dairying but continues to produce wheat and corn-fed meat animals.

Areas of notably low intensity of production (below 10 gallons absolute) within the region where dairying is at least a major farm activity (over 50 relative) will be readily recognized as particularly rough mountain or poor-soiled hill areas. Most striking are the Adirondacks in northern New York, the White Mountains, the hills and mountains of interior Maine and the barren sand-plains in the northeast of that state, and the thin-soiled, almost unused, margin of the Alleghany Plateau in northern Pennsylvania.

Formerly the more interior portions of this northeastern region were concerned with the production of butter and cheese, but the increasing demand of the cities from Boston to Philadelphia and in the Pittsburgh-Cleveland area has caused the fresh milk territory to expand practically to the Canadian border. In addition to the increase of urban population there has been a marked increase in capita consumption of fresh milk and milk for icecream. From 1919 to 1929 the production of milk per capita of population for all purposes in the United States increased by more than one sixth; in the same period the sale of butterfat from Vermont farms was cut to one half, the sale of whole milk practically doubling. In this entire region only two counties show sales of butter and butterfat greater than those of whole milk; these are in the more isolated part of western Pennsylvania. (Whether milk for cheese is more important than fresh milk in any counties in northern New York is not determinable but certainly cheese production there has greatly decreased since 1919.)

In the borderland between North and South production of butter as well as fresh milk is of major or minor importance in several areas. In the broken hill country of the Ohio Valley from Wheeling to Louisville conditions are somewhat similiar to those of the unglaciated area in Iowa and butterfat is the principle source of farm income. The Kentucky Bluegrass is a special and particularly interesting case where dairy, as well as beef cattle, are pastured in rotation with tobacco production to maintain soil fertility.

In the more deeply dissected uplands of the southern Appalachians and the Ozarks dairying is of some relative importance, chiefly because of the lack of other products. Both the absolute amount of milk produced and the amount in proportion to farm population are low, but the comparison with cropland indicates that milk products form an important element of food production as well as a minor cash product. Farm conditions in these two highlands are similar, as is well known, though conditions in the Ozarks are less extreme. Isolated from railroads and good highways, in contrast to the northern Appalachians or the Ohio Valley, the farms in both areas are predominantly subsistence rather than commercial. The cattle, of poor breed, graze in the brush of abandoned fields or cut-over areas and produce relatively small amounts of milk, most of which is used for butter for the relatively dense mountain population.

Although the amount of milk produced on the mountain farms provides for but a low per capita consumption, wherever local markets are available, as near the coal mining towns in the Middle Appalachians, or resorts like Asheville, milk and butter as well as eggs, vegetables, fruits, etc., are sold, and in the few districts tapped by railroads butter is shipped out. In the Ozarks, the dis-

trict near Springfield, Missouri, is particularly well served by rail. On the northeastern margin of the Ozarks the area of some dairy production extends to the district that supplies St. Louis with fresh milk, and no doubt accounts for the low intensity of development there. The southern boundary of both these regions coincides with the northern limit of important cotton production.

Throughout the corn-meat belt of the northern interior and the commercial grain farms farther west, dairy cattle are generally found as a minor part of the farm system, producing a considerable surplus for sale, as butterfat. While relatively minor in comparison with other farm products the production per acre of all land is considerable, particularly in Iowa. In the extensive grain farms of the Dakotas the production per farm is fairly high and because of the small city population in that area the amount of butter shipped out is in total very considerable. There is definite indication of some diversification in this portion of the wheat belt. But dairying is relatively important only in small "islands" around important cities, notably Kansas City.

Similarly the islands in the southwest represent districts of fresh milk production for Richmond, Atlanta, Birmingham, etc. These contrast sharply with the low production of dairy products in the Cotton Belt in general. One or two special cases, notably in Mississippi, are not near any large cities and apparently indicate some effective diversification unusual in the Cotton Belt.

Along the southern coasts, from Georgia through Texas, are scattered districts of dairy production of very low intensity. These reflect not merely the presence of port cities but also the small amount of cultivation, much of it intensive fruit and vegetable production, on the sandy and marshy coast. Milk is obtained from low-breed dairy cows grazing in the cut-over pine-lands. Particularly notable is the strip of coast from New Orleans to Mobile and Pensacola.

Pacific Coast Belt. The third major dairy region of the United States extends in a rather narrow belt from the Canadian border through western Washington and Oregon to southern California. The greater part of this belt, as far south as San Francisco, is a surplus dairy region where the combination of mountainous relief and cool summer rainy temperate climate is particularly suitable for this type of land use. Farther south, in the Mediterranean climate, dairying is important not only along the western slope of the Coast Range but also in the flat lands of the San Joaquin Valley and the Los Angeles Plain. The production here of course is chiefly fresh milk for the local population and the urban centers at San Francisco Bay and Los Angeles. The farms are much more concerned with intensive orchard and truck crops, but a relatively large part of the area is used for barley, hay, and pasture for the dairy cattle.

The intensity of production is necessarily low throughout most of this largely hill and mountain belt. Excepting for two districts near San Francisco, production per acre of total land is not over 20 gallons in any single county, though no doubt the lowland portions of the Puget Sound and Willamette Valley counties would show higher figures if they were separated from their mountain portions.

Although the northern part of the belt produces a large surplus it is not sufficient to supply the deficit in California. The total production of the three Pacific states would provide a per capita consumption of 93 gallons, or 107% of the United States average, but because

of the high standard of living in that area the actual consumption is even higher. California and, probably, eastern Washington draw upon the butter production of the intermontane irrigation districts.

The Irrigation Dairy Districts. Almost every one of the irrigation districts of the intermontane region appears on the map as a dairy district of some importance. Further, the other maps indicate that, excepting in the south, these are districts of surplus production. In many of them of course the farmers obtain more income from concentrated fruit or vegetable crops, or sugar-beets, or from alfalfa sold to neighboring ranches, but in the districts near large cities—Denver, Salt Lake City, and Butte—dairy products, chiefly fresh milk, constitute the largest single item in the farmers' income. (The valleys in the northern Rockies have been included with these districts even though they may not depend on irrigation.)

Since most of the counties of these states include areas far larger than the irrigation districts it is not possible to measure the intensity of production, which in fact is probably quite high.

Outside of the irrigated districts there is apparently considerable dairy production throughout the central and northern portions of the intermontane belts (north of Arizona-New Mexico). This is apparently a minor feature of grazing and dry-farming. The production not only exceeds the requirements on the farms but in most counties provides a surplus for shipment, chiefly as butter but also as cheese, to neighboring cities, to Arizona and New Mexico, and to California.

FIGURE 3.—In areas marked by vertical lines, 1 and 2, cream sold for butter-fat and butter sold from the farm exceeded in value cream sold for cream and whole milk sold from the farm; in areas marked by horizontal lines, 3 and 4, whole milk and cream were more important for sale. The latter include areas, as in north central Wisconsin, where most of the milk was sold to cheese factories. In areas marked by broken lines, 1 and 3, the production is actually small, less than 10 gallons per acre of all land. (Based on the U. S. Census for 1929, by counties.)

Division of market areas. The

Rocky Mountains appear to constitute a definite divide between eastern and western dairy markets. Judging from the receipts at Boston, New York, Philadelphia, Chicago, San Francisco, and Los Angeles (Yearbook, U. S. Dept. Agric.), the intermontane region ships its surplus of butter and cheese to California, while eastern Montana and all of the Great Plains states, including parts of Montana and Colorado, ship to the east. Little or no butter is received at the California markets from middle-western and eastern dairy areas. Even the cheese shipments from Wisconsin and New York are relatively small, San Francisco receiving over eighty per cent of its needs from the western states—in about equal amounts from California, Oregon, and Idaho. (The total cheese production of the western states is now greater than that of New York, or nearly equal to the entire eastern half of the country if Wisconsin and New York be omitted.)

Between the middle-western and eastern areas there is no similar division of markets, the seaboard centers receiving most of their butter from the Middle-west (including the Great Plains states), their cheese chiefly from Wisconsin, and Philadelphia reaches as far as Minnesota for its cream. Somewhat surprising, perhaps, are significantly large shipments of butter to New York, Philadelphia, and Chicago, not only from the border states of the South, but even from Mississippi and Texas (the totals from the South amounting to from three to six per cent of the receipts at each market). Unfortunately there are no statistics of the receipts at southern centers to indicate to what extent they import from the North.

Conclusion

The maps show that dairying as either the leading or dominating farm activity is characteristic of three types of area in the United States: first, the immediate vicinity of cities in all parts of the country, second, areas in the humid parts of the country which are handicapped for other types of farming by a relatively short growing season and/or by rough relief, whether broken moraine plain or hill or mountain country, and, third, irrigation districts and mountain valleys in the northern part of the semi-arid region (north of 37° latitude). With the modern development of means of transporting cheaply for long distances all dairy products, excepting fresh milk, the second type of area has become far greater in extent than the others. Within the principal dairy belt the exceptional areas in which milk production is less important are: fertile plains, and—more strikingly—areas of sandy soil, including some, in both cases, close to large cities; and areas with inadequate transport facilities.

Study of the other major dairy regions of the world, notably in Europe, indicates the same principle. The dairy districts about each American city are, however, much larger than in Europe because of the much larger consumption of fresh milk by urban dwellers in America. An additional type of dairy land, important in northwestern Europe, that of the wet polder or other poorly drained lowlands, is not found to any marked extent, if at all, in the United States. On the other hand the importance of dairying in irrigation districts, as well as in the region of Mediterranean climate in California, is a peculiarly American development. The population of these areas maintains customs of diet and agriculture inherited from northern Europe in regions of utterly different environment, as well as other characteristics that indicate the alien source of their culture.

LAND USE IN THE UPPER ARDECHE RIVER VALLEY OF FRANCE*

Earl B. Shaw

IN THE Cevennes section of the Central Plateau of France, that eastern fault scarp of the ancient massif which descends steeply to the valley of the Rhone, several rivers are cutting gorge-like valleys as they make their way from plateau levels to the master streams below. Along one of these rivers, the Ardeche (Figure 1), found in the French department of the same name, some one hundred and eighty kilometers north-northwest of Marseilles, is the little town of Thueyts, a small settlement of only a few hundred people. Near the town site the river is about four hundred meters above sea level, whereas on either side the steep slopes rise to heights of a thousand meters or more. In spite of this difference between plateau level and the river itself, the town site (Figure 2) and its immediate environs show softer relief features than much of the Upper Ardeche Valley. The smoothing agent was a basaltic flow of Quaternary age which has evened some of the surface irregularities produced by earlier stream erosion through the mica-schist and gneiss, the major rocks of the section.

FIGURE 1.—Vicinal location of the upper Ardeche region.

From stream bed to plateau summit, striking contrasts in land use may be seen, due not only to differences between basalt and gneiss soils, but to differences in exposure, slope, and elevation. It is the purpose of this study to point out human adjustments to these and other physical factors in the Ardeche Valley near Thueyts, and to indicate how the people make a living in this somewhat isolated and difficult environment.

A highly generalized north-south topographic profile across the east-west trending Ardeche shows four major land use zones (Figure 3): (1) lowland meadows adjoin the stream where less resistant rocks have allowed flood plain development, in places as much as two hundred meters wide; (2) terraced patches of fruits with understory crops of vegetables and cereals occupy the slopes above the first zone to a height of nearly six hundred meters; (3) chestnut groves are found where the fruit drops out, and extend to heights of eight hundred and fifty meters where they give way to (4) small groups of beeches in much larger areas of natural upland pasture.

* The writer is deeply indebted to Dr. Raoul Blanchard of Grenoble University for suggesting this study and criticizing the manuscript. Mr. Moulin, superintendent of schools at Thueyts, also aided greatly with valuable information on various sections. Without the help of these men the research would have been extremely difficult.

FIGURE 2.—The town of Thueyts. In the foreground one may see the gorge-like wall that the Ardeche River has cut through the basaltic platform upon which the town is built.

LOWLAND MEADOWS

The lowland meadows (Figure 4) of the Upper Ardeche occupy but little of the region, probably not over one or two per cent, yet production of feed per unit of land is many times greater than that of the grazing section at or near the plateau summit. Such grasses as clover or alfalfa are planted, a type of culture known throughout France as "les pres artificiels." The little flood plains are never pastured, but two to four crops of hay are cut each year, the number of cuttings depending on the season. The first crop, the heaviest, is allowed to mature completely before the farmer goes in with his scythe to mow it, whereas later growths may be mowed before ripe, and, consequently, yield less. The hay is fed to livestock; most farmers keep a cow, two or three goats, and a half dozen or more sheep, which are stall fed during most of the winter and even in part of the summer season. Hay may be taken from field to hay shed, which is located with other farm buildings on the slopes above the flood plain to escape flood damage, by one of two methods. It may be wrapped in burlap and carried up on horse or mule back, or by the farmer himself.

Owing to stream bank location and extreme variations in the flow of the Ardeche, lowland hay growing suffers serious flood damage on an average of once every three years. Meadows will stand high waters of two or three meters with little impairment, but beyond this level, losses are severe. During periods of high water, the fields are strewn with boulders which are picked up later and may be used in fencing or terracing. The location which exposes hay ground to flooding provides a real advantage during periods of low precipitation, for irrigation is always possible even in situations slightly above the stream course. Methods of irrigation are primitive yet entirely effective.

Land holdings on the flood plains, like those of the whole region, are in little strips of a half acre or more in size. Many farmers own small parcels of each continuous hay field, one of approximately ten acres being owned by twelve different peasants.

Besides "les pres artificiels" of the Ardeche stream bank, meadows of somewhat greater extent are found on terraces in the major zone of fruits, vegetables, and cereals. During the dry season water is obtained from springs or small valley tributaries to the main

stream. Yields are not as high on these terraces, for water supply is often inadequate, and the slope soils are not so rich as the alluvium on the valley floor. If farm buildings are located on the opposite side of the stream from the little hay fields, the crop may be transported across the V-shaped valley by means of a heavy wire cable (Figure 5).

THE ZONE OF FRUITS, VEGETABLES, AND CEREALS

Grapes, cherries, apples, pears, and plums comprise the main fruits grown around Thueyts. The vine covers a larger acreage than any of the others, probably as large as that of the remaining four combined, yet the sale of grapes and wine is less than that of the tree fruits. Each farmer makes his own supply of wine and usually claims it to be the best in the province if not in France, a statement which would be hard to prove. Wine is the principal drink, just as it is for the entire country, and forms one of the three main items of diet for the French peasantry—wine, cheese, and bread. No farmer starts out to the field for the day without his bottle of wine, and some consume as many as three quarts each before returning home.

The above mentioned tree fruits provide the money crop for the region and have done so for approximately forty years, since hard-surfaced roads and train service from towns not far distant assured adequate transport for the harvests. Several conditions favor fruit growing near the town of Thueyts.

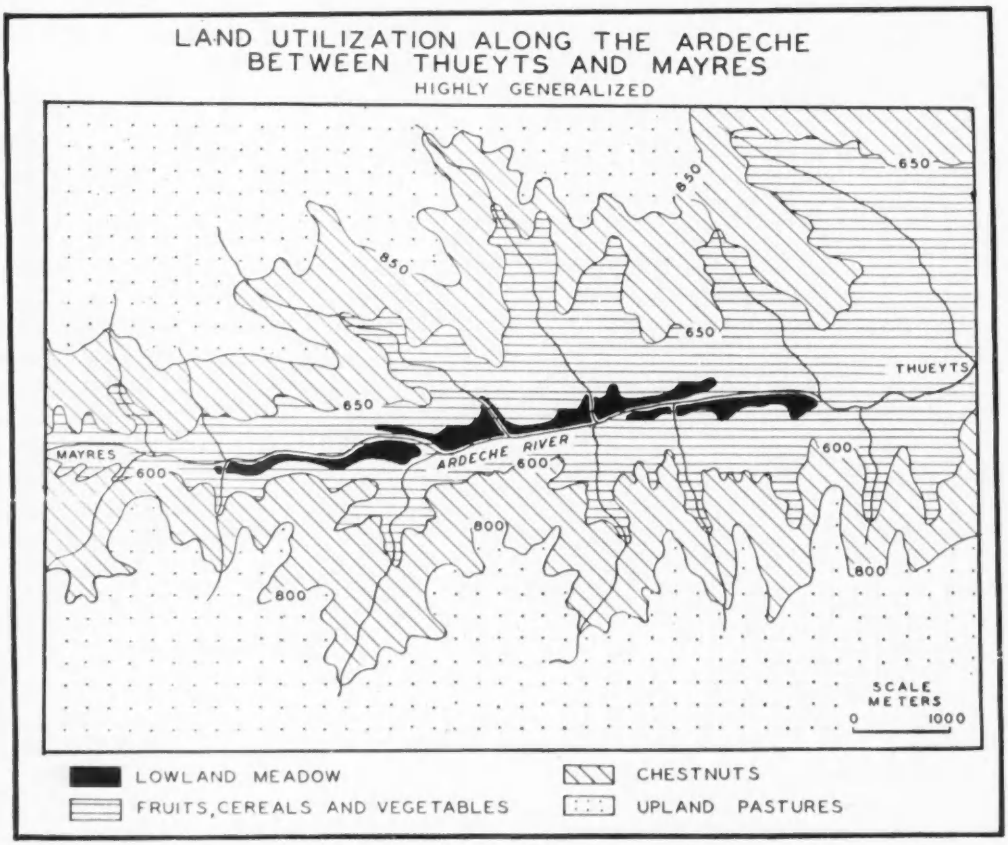

FIGURE 3.—Land use along the upper Ardeche River between Thueyts and Mayres. Southern exposure accounts for the higher elevation of crop zones on the north side of the stream.

FIGURE 4.—Lowland meadow. The main irrigation ditch runs through the center, with minor ones branching laterally. The rocky river bed may be seen at the left of the picture.

Thousands of trees are planted on the rich soil of the Quaternary basaltic flow, a soil far more fertile than those derived from the mica-schists, gneisses, and granites which dominate the Upper Ardeche. The dark color increases heat absorption and the friable texture favors easy cultivation. Moreover, the lava flow in the vicinity of Thueyts is mostly on the north side of the Ardeche River so that orchards get the advantage of extra sun exposure which accrues to south-facing slopes. Again, the region is far enough south to eliminate winter frost damage—the mean minimum temperature for the coldest month is about thirty-four degrees Fahrenheit—yet there is sufficient cold to assure an adequate rest period for the trees (Figure 6). Elevation is sufficient to insure mild summers, so favorable for temperate fruits. The east-west trend of the valley adds another advantage; for if the river flowed south instead of east, the hot winds from the Midi, which lies just below this section, would find an easy passage up the valley in summer, and, conversely, the cold winds from the north would flow down to the lower pressure of the Mediterranean just as easily in the winter. Precipitation is ample for the growth of fruit, ranging between forty-five and fifty inches, with distribution slightly less favorable. The major maximum comes in the fall with a secondary in the spring, the latter being more advantageous to fruit growing than the former. The causes for the fall and spring maxima are no doubt associated with both convection and cyclonic storm influences which prevail at these seasons, whereas in summer the sun alone dominates and in winter the storm element becomes the major control. Rainy days range from sixty-five to ninety a year, giving the region a large percentage of possible sunshine, a condition highly favorable to fruit culture.

The heat and aridity of the neighboring Midi bar many temperate fruits and some of the Ardeche crop finds a market here. The remainder may be sent to other parts of France or to her colonies, to England, Switzerland, and Germany. When there is sale for the fruit, little is canned or used fresh locally, for the peasants know that fruit money provides their main revenue, and are anxious to turn the entire crop into cash.

At the time of harvest farmers bring

their fruit to town and here buyers assemble to purchase the crop. When yields and market price are good, the little village square is buzzing with commercial activity. Buyers forward consignments immediately to French or foreign destinations, the market depending on the kind of fruit and the demand.

The problem of an adequate market is one of the difficulties facing the region. The aim of each nation for self-sufficiency has cut down the foreign outlet, especially that of England, which, in recent years, has taken a large share of the crop. Moreover, the demand in France does not equal the present production. Other retarding factors include the persistence of antiquated methods of preparation and packing as well as the lack of coöperative organizations like those which have helped the fruit growers in the Rhone Valley to the south. The "every-man-for-himself" method of production and marketing and a limited market do not augur well for the future of the industry. In short, physical factors are favorable, but human, economic, and political influences present an outlook none too bright.

Before fruit raising became important, wheat was the dominant revenue producer, although it provided a much smaller income than is now available from fruit. At present, little wheat is grown. Rye, barley, and small patches of oats serve as intertilled crops (Figure 7) because they thrive better than the major bread grain under the shade of the tree-bordered terraces. Furthermore, barley and rye show better adjustment to the generally infertile soils which lie outside the immediate vicinity of Thueyts. On the rich basaltic platform near the village even rye, the grain of poverty, gives way to alfalfa, or to vegetables such as potatoes, peas, green beans, tomatoes, carrots, cabbage, beets, and turnips, all of which give a greater return on rich land.

FIGURE 5.—Aerial hay carrier. Cable and pulley are used in transporting hay across the rugged Ardeche Valley.

Hand methods predominate in the growing and harvesting of cereals.

Topography, small size of holdings, and poverty of the peasants preclude the use of machinery. Grain is first separated from the straw by beating with a flail or by using a heavy roller drawn by animal power. After this, the straw is removed and the grain separated from the chaff by running them both through a small hand-turned fanning mill.

Cereals furnish food for man and for livestock. Before fruit became important, the farmers made bread from local wheat. Now flour and bread are shipped in and the new money crop provides cash for its purchase.

THE CHESTNUT ZONE

Above the zone of fruit and cereals the land is covered with chestnut trees. These extend to an average height of eight hundred meters but on the north-facing slopes the upper boundary is as low as seven hundred and fifty meters, whereas on the south facing slopes it is as high as eight hundred and fifty. During the past fifty to seventy-five years, chestnut culture has progressively occupied a wider zone, its lower limit expanding at the expense of cereal and fruit growing. Fruit and cereals have given way not because they were planted at too high altitudes, but because their low yields made chestnuts more profitable on the poor gneiss and schist soils. Chestnut groves may be found on abandoned fruit and cereal terraces (Figure 8), but new plantings are never terraced.

The chestnut industry of the Thueyts region is an old one and the nuts formerly supplied an important element of the peasant diet. Fewer are now used for this purpose and some are fed to hogs. In places where nuts of high quality are raised, the yield is sold to candy factories in Privas or Aubenas, larger towns thirty to forty kilometers away. On some farms, the old chestnut drying shed forms part of the building layout. In years of lean fruit crops it may still be used. The drying process occupies as much as two months, the nuts being dried over a slow smoky fire of heavy logs. The chestnut logs themselves provide a product in the form of tannin, two small tannin distilleries being located forty or fifty kilometers down the valley. When trees are cut for this purpose care is taken that the cutover land may suffer no reforestation handicap. A law in the Ardeche province makes it obligatory to keep such land free from animals for five years and thus gives the new chestnut shoots a chance to gain a foothold. The prevention of soil erosion is very important to these terrace farmers. Some land owners use the large crop of chestnut leaves for livestock bedding. Straw is

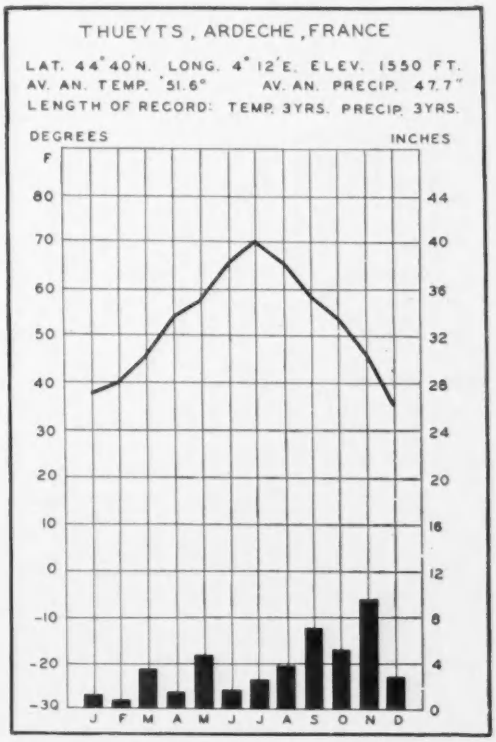

FIGURE 6.—Climatic chart. The short period of observations (1932–1934) accounts for the unusual occurrence of the minimum temperature in December. Long records from nearby stations show January to be the coldest month.

not abundant in the region and the big leaves provide a good substitute. Moreover, they add considerable bulk to the animal manures which are used to fertilize the poor soils so characteristic of the Upper Ardeche.

THE UPLAND GRAZING REGION

Above the chestnut zone lies the upland grazing region, a pasture land where natural grasses provide summer feed for the animals in the region. Small clusters of beech dot the lower limits of the grazing zone, trees that can stand the more exacting temperature conditions of the higher altitudes slightly better than the chestnut. These clusters are of little economic importance. As previously suggested, the carrying capacity of the plateau pastures is much less than that of the flood plain hay fields, but the total acreage is many times larger.

In the Ardeche province as a whole these high pastures may belong to individuals, to several peasants in common, or to the neighboring town. Near Thueyts, this grazing land is almost entirely privately owned. Last year two shepherds, who drove to the surrounding highlands sheep belonging to the farmers in the vicinity of Thueyts, cleared eight thousand francs for the summering of the flocks. The shepherds rent the mountain land from the proprietors paying anywhere from twelve to thirty francs an acre and receiving seven to eight francs a head for each sheep they care for during the season of transhumance, June to September. Ten to fifteen animals make up the average lowland flock, but a few farmers keep none at all. The combined herd may number from one thousand to twenty-five hundred. In some cases the sheep herders descend to the village nightly leaving the herd on the highlands, while in other cases the villagers send food and supplies to the shepherds once or twice a week. The chief route to these high feeding grounds lies just north of Thueyts and large flocks have been driven over this trail for hundreds of years.

FIGURE 7.—Rye stack. The small bundles are tied with strings made from the straw.

FIGURE 8.—Chestnut trees on abandoned fruit terraces.

A TYPICAL FARM UNIT

Outside of the small towns, which are found along the main roads at short distances, houses and sheds of three or four farmers (Figure 9) are usually found in close proximity, the small clusters looking like miniature villages. On the farm of Mr. Emile Rousset, the house has a large basement which is divided by temporary barriers into sections for two cows, five goats, three pigs, a half dozen rabbits, and fifteen chickens. These animals furnish meat, milk, cheese, butter, and eggs for the table and their manure provides fertilizer for the soil. Cows and goats are all milked, the cows' milk being used for drinking purposes and for butter, and the goats' milk being made into cheese, one of the major items of diet for the French peasant. Livestock usually does not furnish any cash income, but the food it provides enables the family to get along with very little cash. An enclosed portion of the porch on the northwest side of the house is used for a carpenter shop (Figure 10). To the southeast of the living quarters is a large cement-floored plaza, approximately thirty by fifteen feet, which serves several purposes. It is used for the family washing in the summer, a threshing floor in the fall, an eating place on warm days, a "private café" for serving drinks to the few guests who may visit the family, a place to make butter and cheese, a grinding floor for making chestnut meal, and for many other purposes. On the south and east of the plaza is a broad stone railing where flowers of many kinds grow in a confusing array of pots, pans, and jars. Nearby to the southeast and northeast are a wine house and a chestnut drying shed. South of the plaza, the winter supply of wood is piled, sawed in short lengths, and a little below in front of the basement door a large pile of manure is waiting distribution over the crop terraces after all harvesting is complete. To the southeast of the wood pile, hay is stored in a small shed. In many building units, the animals are found in a shed

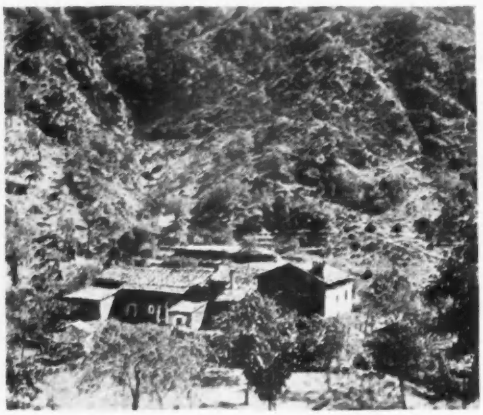

FIGURE 9.—A village unit. Three families live in this cluster of houses.

near or in a basement under the hay barn, but on this farm the house basement provides shelter for the farm stock. Just to the north of the house on one of the fruit and grain terraces, several hives of bees store their honey in hollow logs. Like most all buildings in the Thueyts region, the Rousset house and barns are built of stone, extracted from nearby quarries. Many of the structures are extremely old, a portion of the house just described having been built of stones laid together without cement in the year 1636, nearly three hundred years ago.

The land of the Rousset farm comprises about twenty-five acres and is divided into twenty-four plots, some widely separated (Figure 11). Approximately twelve acres, primarily areas with poor soils, rugged topography, or high elevation are devoted to chestnut growing or left in natural pastures. The remaining land is given over to fruit, vegetables, cereals, and irrigated pasture, cultivated crops which occupy stone-bordered terraces ranging from ten to fifteen feet wide and from fifty to a hundred or more feet in length. This farm is slightly larger than the average for the region, seventeen acres being nearer that figure. The largest land holding in the Thueyts region is approximately forty-five acres and the owner is known as "the king of the fields." This farm is all devoted to fruit trees. There are some hundred or more separate parcels, none of which adjoin the one on which the farm buildings are located. The holdings of the smallest land owners average between one to five acres each. These are too small to produce a living for the family; the owner, and sometimes other members of the family, supplements farm income with money gained from labor outside.

The discontinuity of the Rousset farm, as well as that of the majority of Ardeche agricultural holdings (Figure 12) is largely a result of historical causes and existing inheritance laws. For a long time much of the French land was held in large blocks. Peasants who rented or worked it had several parcels, each suitable for a different utilization because of topography or soil characteristics. For example a rugged section might be best adapted for forest, a less rolling area for grazing, and a level strip for cultivated crops. With the break-

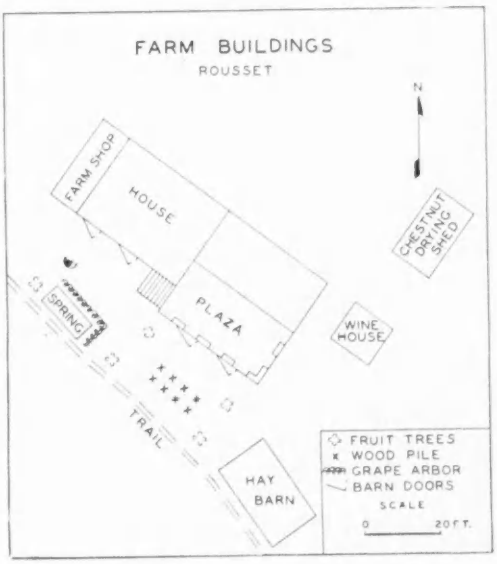

FIGURE 10.—Farm buildings of Emile Rousset

ing up of the large holdings, peasants secured ownership of widely separated plots which they had previously worked for the owners. Moreover, inheritance and marriage separate units even more, for farms bequeathed to several children bring about more divisions. Each child wants some of the good land and must take some of the bad, while if the sons marry, the land dowry, which each may receive with his wife, brings about still greater land discontinuity. Other causes exist for the scattered character, small size, and large number of land parcels, but the above-mentioned are extremely significant.

A tendency toward consolidation is now operative. One of the heirs more frequently buys the holdings of the other children. In the case of the Rousset farm, the son Emile bought the shares of his brothers, although a larger farm had been divided in 1880 between father and uncle. Again, if abandonment and sale of sterile land continues in the Ardeche, as at present seems likely, farm holdings will be much less scattered.

FIGURE 12.—Distribution of land ownership in "La Leoune." "La Leoune," a small section of approximately twenty-five acres near Thueyts, is held by twenty-three peasants. Each of the fifty-eight plots is owned by one person or held jointly. The discontinuity of holdings is evident here as well as in Figure 11.

FIGURE 11.—Distribution and utilization of a typical Thueyts farm. "Lande" is a French word whose meaning in this case is sterile uncultivated land. Much of the thin rocky soil, so characteristic of such areas, is covered with scattered grasses and shrubs. The land between the widely separated holdings of the Rousset farm is owned by several French peasants whose farm plots are as scattered as the small fields of Mr. Rousset.

SUPPLEMENTARY INCOME SOURCES

Throughout the whole of the Upper Ardeche Valley, mills (Figure 13) for the manufacture of silk may be seen. The two mills at Thueyts employ about ninety people and at Mayres, a few kilometers to the west, nearly a hundred employees obtain work at the largest of three silk factories. The bulk of the mill workers are daughters of farmers who own land in the region nearby. These girls supplement the small family income obtained from the arduous labor coincident with terrace agriculture. A few men are employed for heavier work.

The mills are financed by local capital.

FIGURE 13.—Textile mill near Mayres, a few miles west of Thueyts.

Contracts are made with large firms in Lyon, about one hundred and twenty-five kilometers away, for making thread or cloth, according to specifications, of either artificial or natural silk. Local mill owners never own the goods upon which they work. Cloth is brought in and sent out of the region by truck. Transport charges are not important for the commodity weighs but little and has a high specific value per unit of weight.

Power is obtained partly from hydro-electric plants situated along the Ardeche. Rainfall fluctuates so widely that supplementary power must be purchased from distant sources.

A small number of workers are employed in little factories where baskets are made from local woods for shipping the fruit crop. Several workers make a seasonal migration from the region each year—south to Carpentras to pick strawberries, in the same direction to Cavaillon to pick tomatoes, to the Languedoc plain farther south to pick grapes, to the Rhone delta to work in the salt harvest, and to the valley of the same river to harvest grain.[1]

SUMMARY AND CONCLUSIONS

With the exception of the areas of basaltic soil, the Thueyts section of the Upper Ardeche Valley is like most of that wild stream valley—a country of difficult farming conditions. On the lowland pastures floods coming during the September and October maximum rainfall period destroy the plantings one year out of three. In the fruit and cereal land, the building and repairing of terraces requires much effort, the granite and gneiss soils require fertilization—in some instances baskets of soil are carried from valley bottom to the little stone walled terraces above—the rugged topography inhibits machine agriculture even if the peasant had money enough to purchase power machinery, and on the best soil regions, a bountiful crop may fail to find an ade-

[1] Boyer (A) "Les Migrations Saisonnieres dans la Cevenne Vivaroise," Revue de Geographie Alpine, Vol. XXII, 1934, pp. 571-609.

quate market. In the chestnut zone the farmer must toil to keep down undergrowth in order to facilitate harvest of the crop and if he wishes the wood for lumber or tannin he must wait many years for the trees to mature on the infertile soils. Hence, it is no wonder that people must seek other tasks to supplement their income from agriculture. Some who have gone outside the region for part time work have found permanent positions in a more hospitable environment. There is likely to be even more of an emigration from regions of infertile soils. That emigration has already started. In the canton of Largentiere, a section of the Cevennes characterized by rugged topography and soils similar to those of Thueyts outside the basalt area, the population declined from 15,550 in 1851 to 7,806 in 1926. In the region of lava soils, however, fruit production may expand, all depending on market conditions; and if such expansion takes place some people from the poorer regions may move to the volcanic areas instead of seeking work outside their own locality.

THE KNIT-GOODS INDUSTRY IN THE SOUTHERN STATES

Ben F. Lemert

SIX southern states produce more than one-half of all the hosiery manufactured in the United States and two-thirds of all the cotton hosiery. North Carolina manufactures more cotton hosiery than any state in the Union, her production alone amounting to one third of the total American volume. Tennessee ranks second in the production of cotton hosiery, Georgia third, Illinois fourth, Pennsylvania fifth, and Alabama sixth.

One-fifth of the total value of all knit-goods production in the United States in 1931 represented the value of knit-goods production in North Carolina, Tennessee, Georgia, Virginia, Alabama, and South Carolina. Pennsylvania ranks first in the value of knit-goods production, New York second, North Carolina third, and Tennessee fourth. In hosiery, North Carolina is surpassed in value by Pennsylvania alone, Tennessee ranking third. New York owes her superiority in value to her wide variety and large volume of knit-goods other than hosiery. Pennsylvania holds her prominent position in total value of knit-goods production due to large volume and high quality. While there is still a wide margin between the figures representing total value of production in comparison of these states with North Carolina and Tennessee, such a margin may not be permanent. The six southern states outstanding in knit-goods production already embrace many mills manufacturing underwear, outerwear, knit-cloth, sports goods, gloves, and other articles. The manufacture of full-fashioned silk hosiery is spreading rapidly and using the most modern machines and processes.

Location

The greatest concentration of the knit-goods industry in the South is in the Piedmont of North Carolina, the western piedmont of Georgia, the Coosa Valley and the Valley of East Tennessee. There are several factories in the Coastal Plain, the mountains of western North Carolina, the Tennessee River district of Alabama, and in the plateau and basin section of Tennessee.

History

The beginning of hosiery manufacture in the South was an outgrowth of a desire on the part of men already engaged in manufacture to diversify their investments. Cotton textile manufacture began its upward trend in this region early in the 1880's. Tobacco manufacture began a steady upward trend in 1888. The manufacture of furniture became noticeable by 1900. Prospering in all these industries, southern business men were alert for opportunities to invest their money in types of industry adaptable to the South. Money made in cotton manufacture was invested in tobacco manufacturing. Money received from tobacco manufacturing was invested in cotton textiles and furniture. About the same time the hydro-electric field began to offer opportunity for investment. The sentiment at that time seemed to be aimed at carrying the raw materials produced in the South as far as possible in the field of manufacturing before turning them over to the ultimate consumer. The prevailing doctrine was "Keep the profits of manufacture in the South." The knit-goods industry, chiefly represented by hosiery

manufacture, presented another opportunity to gain control of manufacturing processes necessary to fit the South's raw materials for consumption.

Mills producing hosiery began appearing early in the 1880's. In sections where cotton textile manufacture was gaining importance the money for such enterprise came from that source. In Durham where cotton and tobacco were being manufactured with ever increasing volume, the investment sources were in both of these industries. In western North Carolina where furniture manufacture began to reach its stride about 1900, money came forth to the knit-goods industry. There is no doubt some of the profits reaped from the development of the hydro-electric industry may now be found invested in the knit-goods industry. I know of one large estate which has its investments spread over not only these four outstanding industrial developments, but also holds blocks of stock in several other southern industries.

The time for the establishment of such industries in the South was propitious, especially for industries manufacturing textiles. The first product of the knit-goods industry was cotton hosiery. The yarn was being manufactured close to the hosiery mills. The cotton for the yarn was grown nearby. Cotton prices were steadily declining. Fluctuations in the price of yarn were never sharp enough to cause inconvenience. The operation of the knitting machinery re-

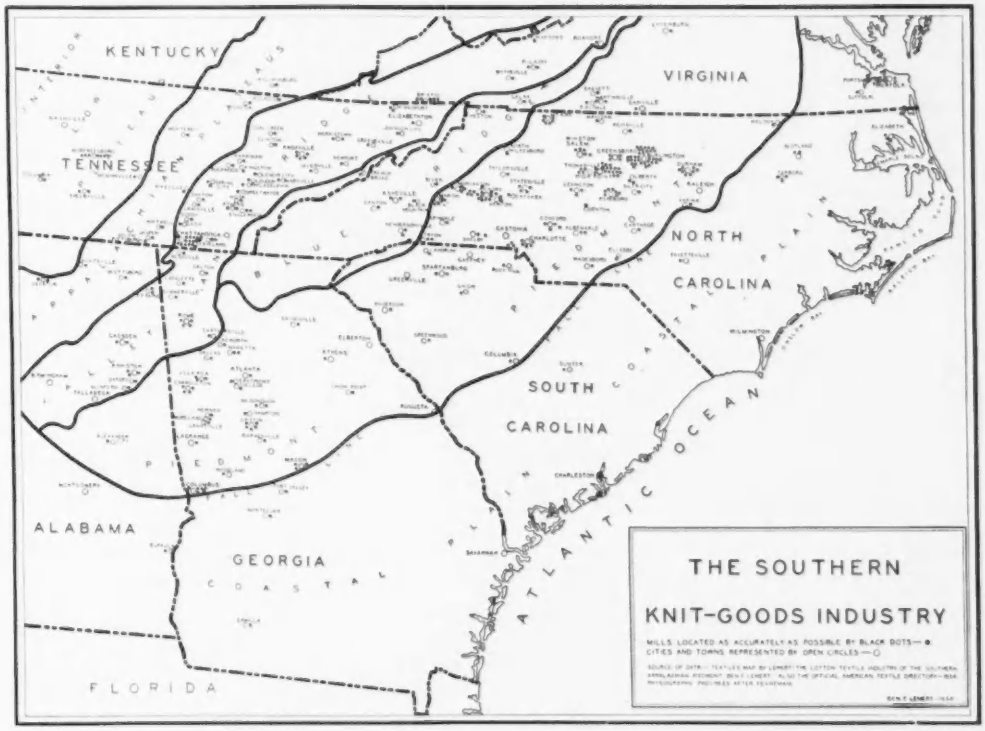

FIGURE 1.—The greatest concentration of the southern knit-goods industry is in the piedmont of North Carolina, the western piedmont of Georgia, and the Valley of East Tennessee. The locational influences of this region are: (1) Abundance of labor; (2) nearness and abundance of raw materials; (3) widespread availability of fuel and power; (4) efficient transportation; (5) climate. The blank areas in mill distribution are either the result of lack of these influences, or due to the inhabitants taking greater interest in cotton spinning and weaving. Minor mill concentrations are the result of locational influences in combination with human influences and the economic advantages distributed by the former basing-point system of railroad rate making.

TABLE I

VALUES AND QUANTITY

State	*All Knit-Goods Production Value*		*All Hosiery Production Value*		*Quantity, Dozens of pairs, 1929*
	1929	*1931*	*1931*	*1929*	
Pennsylvania	$294,322,880	$178,134,807	$123,425,022	$221,702,551	29,002,551
New York	158,110,012	101,470,090	12,069,416	21,519,444	2,699,522
North Carolina	86,112,765	69,087,446	62,788,086	75,506,332	32,320,985
Wisconsin	51,549,464	27,965,725	21,400,055	39,918,715	5,339,330
Tennessee	48,406,388	33,071,977	24,404,176	36,548,938	11,914,585
Massachusetts	41,050,135	29,460,966	6,511,704	10,279,620	1,031,992
New Jersey	35,480,337	25,343,257	15,924,584	23,996,589	2,594,830
Indiana	32,153,951	18,649,631	16,845,440	23,238,628	2,912,028
Georgia	19,377,923	13,863,116	11,160,454	14,020,184	5,556,135
Ohio	18,562,132	10,640,344	587,028	.....	.....
Illinois	16,948,041	11,863,293	6,614,449	10,245,824	4,285,364
Virginia	9,381,123	6,523,565	4,733,003	4,907,476	2,083,232
Alabama	6,666,184	7,695,057	4,034,068	3,814,109	1,554,341
South Carolina	2,828,522	1,596,581	1,596,581	.....	.....

The proportions of the knit-goods industry of each state devoted to the hosiery manufacture is made clearer by the position of the 1931 columns.

Source of data—Census of Manufacturers.

quired little skill. Labor was abundant, low-priced, and possessed enough intelligence to learn quickly and be willing to undergo the necessary discipline. The market for cotton hosiery was just outside the doors of the mills. The prices received for the product remained exceptionally stable. All these influences must have operated to foster the development of such an industry. The very scope of the industrial evolution which was taking place in the Piedmont and the Great Valley sections of the South offered increasing opportunity.

The knit-goods industry has steadily expanded in the South. With one exception, local influences have remained favorable. The one exception may be classed as a recent development. Its continuance is problematic. Labor discord, if increased, may result in destruction. The external influences affecting the knit-goods industry have been both favorable and unfavorable. Following 1920, although many new hosiery mills were built in the South, business conditions were not good for the industry due to unsettlement in the world market. Rapidity of change of styles and tastes caused much instability. At the same time, changes in styles and tastes have influenced improvement in quality of southern hosiery production, installation of the most modern equipment, and increasing effort to attain the highest degree of efficiency. In 1929, North Carolina produced over $74,000,000 worth of hosiery. While her greatest volume was cotton hose, the total value of the cotton hosiery amounted to but $15,500,000. Her silk hosiery sold for $19,000,000; her rayon hosiery for $20,000,000, and hosiery made of mixtures or combinations of silk, rayon, or cotton, sold for $15,500,000. Figures for 1931 and 1933 should show even greater proportion of higher quality production indicating continuous and rapid improvement in this type of manufacturing in the southern states.

LOCATIONAL ADVANTAGES

The chief locational advantages accruing to the southern knit-goods industry are: 1. an abundant supply of labor that is efficient, intelligent, coöperative, and can be obtained at a reasonable price; 2. nearness and abundance of the supply of raw cotton, cotton yarn, rayon yarn, and the ease with which silk may be obtained; 3. the availability of fuel and power any place throughout the southern industrial section at a price permitting their application to manufacturing processes; 4. efficient transportation for raw materials and for finished prod-

ucts; 5. climate in its effects upon workers, upon human activities in the whole region, and upon factory construction and maintenance costs.

LABOR

The supply of labor in the South has been generally abundant from the inception of manufacturing. It will continue to be abundant for many years if the present method of relief is not continued long enough to destroy its incentive to work. Recently there have been cases where mills had to seek employees although thousands of potential workers are living on charity.

The area of industrialization in the South, coinciding with the distribution of the knit-goods industry, extends from Lynchburg, Virginia, throughout the Southern Appalachian Piedmont as far as Montgomery, Alabama. From the vicinity of Montgomery and Birmingham, this industrial area recurves upon itself, extending up the Coosa Valley and the Valley of East Tennessee, into the valleys of western Virginia.

The people of the Piedmont and the

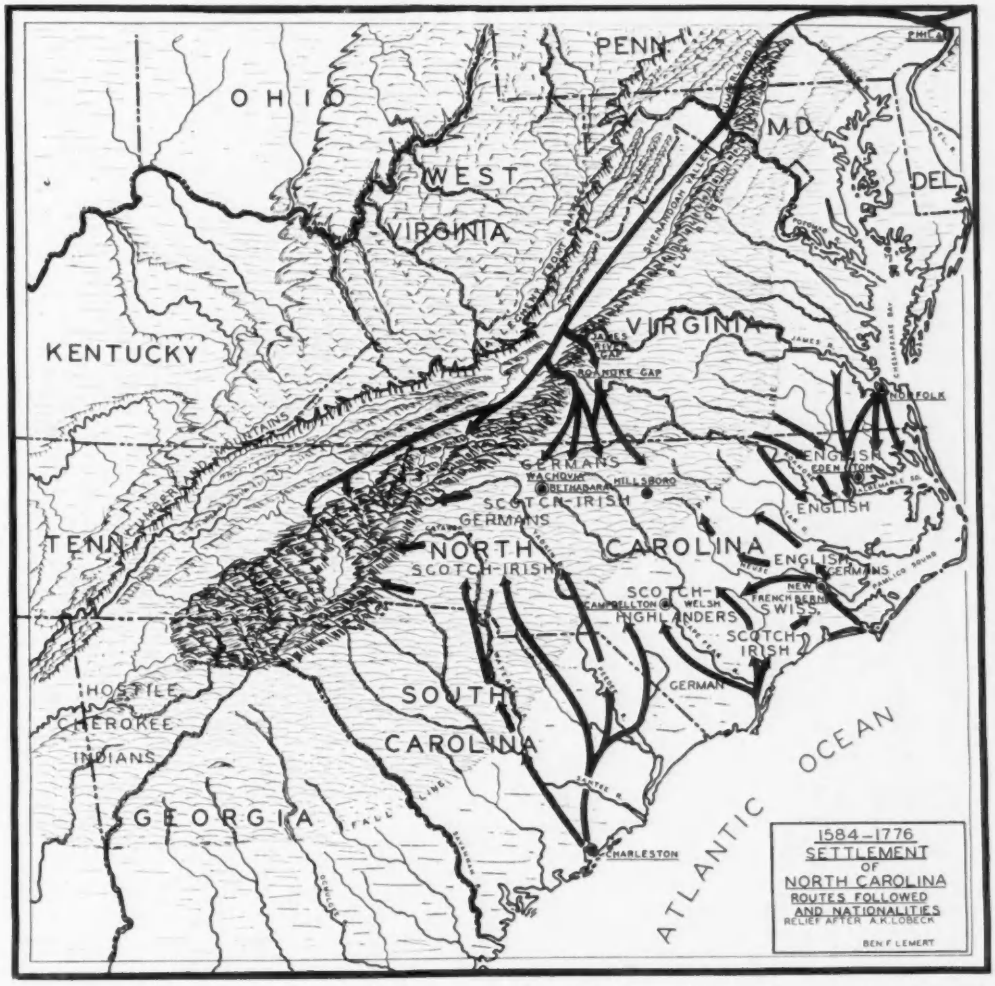

FIGURE 2.—Southern textile workers are noted for their adaptability. The Scotch-Irish, Irish, Germans, and English who settled the South were familiar with spinning, weaving, cabinet making, and other household arts. Adaptability is in large measure an acquired characteristic, each generation acquiring it from the previous generation.

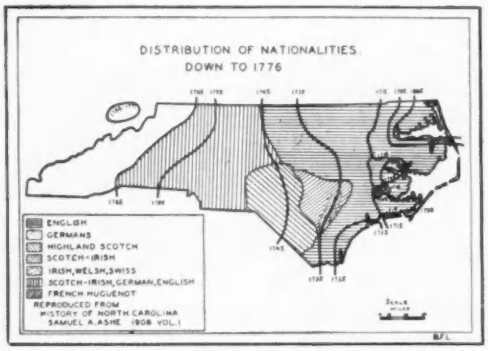

FIGURE 3.—By 1776 North Carolina, east of the Blue Ridge, was completely occupied by north European peoples. People of this type have been responsible for the world's greatest industrial developments.

Great Valley have been engaged in agriculture for more than 300 years. The nature of the soil, the distribution of topographic features, and the type of people originally settling these regions influenced development of small farms. Distance from markets and poor transportation encouraged self-sufficiency and limited variety of crops. Climate and soil further limited human activities, directing them into specific channels, such as the raising of tobacco, cotton, and corn. Where such crops could not be profitably produced, the people turned to wheat and livestock. The mountain dwellers were further limited in their choice of activities by the roughness of the topography.

The entire industrial region is surrounded by an agricultural area, the Coastal Plain on the east, the Gulf Coastal Plain on the south and southwest, the Appalachian plateaus on the west and northwest, and a Piedmont region better adapted to diversified agriculture on the northeast. Throughout the area of the southern states the population has maintained a steady natural increase for many decades (Figure 4). A portion of those born may look to a future in agriculture. New methods and developments such as the fruit and early vegetable industries of the Coastal Plains make places for others. A large portion cannot find room upon the land and must look elsewhere for means of earning subsistence. This statement applies with increasing force as one proceeds from the Coastal Plains or the Valley area into the Piedmont, the mountains and the Appalachian plateaus. Another force influencing the numbers available for industry is the negro population, which, like lava flowing down a valley, quickly fills and overflows the holes in the agricultural labor force and maintains the level of common labor. Even though in sections there is plenty of land that could be occupied by the increasing population, our stage of economic development tends to prohibit its occupation indefinitely. Manufacturing industries provide the chief outlet for this potential labor supply. In this field, too, the forces of progress seem to cut down the openings faster than natural expansion of industry can widen them.

Some mill owners express amazement at the adaptability of the southern worker. It is just a case of acquired characteristics, each generation acquiring from the generation before. The Scotch-Irish, Irish, Germans, and many of the English who settled the South were weavers, spinners, cabinetmakers, and wheelwrights in their homeland. In the pioneering regions which they settled they were forced by their environment to continue producing most of the clothing and equipment they used. The child born in this environment found among the first things he came to notice, the spinning wheel in operation, the hand loom, or the working in wood. He learned adaptability in these trades and his children learned from him. Doubtless there are workers in southern mills today who early became acquainted with the textile industry via the spinning wheel and handloom in their former mountain homes. When they come to

the mill they are in an environment where the thought and activities are bound up with textiles. Their children grow up in the mill atmosphere. If at all intellectually alert they should quickly become expert at the manipulation of such machinery. I have heard employers say: "Three weeks from the farm and these people can run any of our machines." I wonder, since the machines run themselves and the labor is chiefly that of tying threads, if those employees had not already learned to tie threads, handle knitting needles, and pull levers in their mountain homes and learned it from childhood? As a boy, though not born of a mill family, I spent several summer vacations working in hosiery and woolen mills. I knew nothing of tying threads or operating such machines. A few tries and I could tie them as well as anyone, and the running of the machines consisted chiefly of learning how to start and stop them. That, too, could be acquired in a very short time.

Coöperation between employers and employees has been practiced to a great extent in the southern knitting industry. Sometimes the labor is described as tractable. It is tractable, partly due to the intelligence of the stock from which the labor springs (Figure 2), but mostly due to environment. The southern worker, in many cases, can still look from his machine out upon the field of agriculture where those perhaps not as fortunate as himself still labor long hours in a hot sun and receive very little compensation. If he does not care to work in the factory, common labor with negroes, or farm labor, await him. Both are arduous and neither will bring him as much return as his mill job. In neither will he have as decent a place to live or as much money in his pocket. His surroundings in the mill do not resemble a drawing room, but they do, in most cases, represent the best that can be done in the way of working conditions and still get the work done. His employer makes more money than he makes, but the employer takes all the risk with his investment and cannot shed his responsibility upon quitting a machine as can the workman. Perhaps the workman realizes this to some extent. The worker also knows there are many to ask for his job the moment he quits. He may have a wife and children. Knowing his employer, he may be able to obtain jobs for the wife and for the children as they become old enough to work, thus lightening his own load. I pass by many mill houses every day on my way to school, observing negro maids caring for young children while the fathers and mothers are in the mills earning enough money for a comfortable living. I never heard of knit-goods workers in Pennsylvania, Wisconsin, or Illinois having maids to look after their children.

In western piedmont North Carolina, many towns have both furniture factories and hosiery mills. The men work in the furniture plants and the women work the daylight shift in the knitting mills. If one does not wish to remain on the job, the other may, and there is coöperation between the two keeping both at work.

In recent years the coöperation between employee and employer in the southern knit-goods industry has been interrupted by strikes. In some cases the employees have decided their working conditions were not so good as they should have been, or their wages not high enough. In many instances they were brought to this conclusion by paid organizers from other states. Unionism has been spreading throughout the South, given a freer hand since the inauguration of the N.R.A. Thousands of employees entered the unions and the

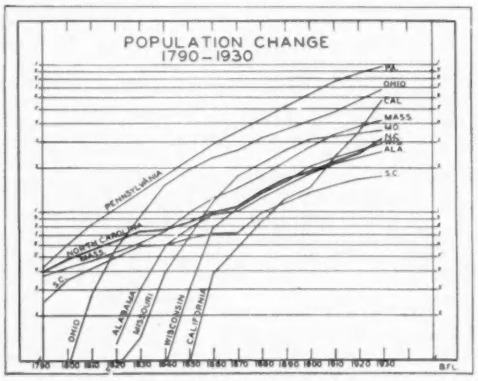

FIGURE 4.—The steeper gradients of the curves on this graph indicate influx of people into the states shown. The gentler gradients indicate natural rate of increase. Influx of large numbers of people into North and South Carolina had about stopped by 1800, while a natural increase to be expected from an agricultural region prevailed until 1870. The increased gradients of these two population curves since that time have largely been due to increased industrial activity, the extra-stimulation of one-crop agriculture, and slightly due to a small influx of outsiders attracted by industrial development.

strike of 1934 resulted. Under the application of the N.R.A. codes, hourly wages had been raised while hours employed had been drastically cut. The resulting increase in cost of manufacture produced a higher selling price. The movement of goods decreased. Manufacturers had to place their products in stock. The outcome was a reduction in hours employed and the employees, while receiving more per hour than they had ever received, worked so few hours their actual earnings shrank alarmingly. Such a condition was ripe for a strike except for the fact that the employers were not averse to entirely closing their factories while the market removed some of their piled-up stocks. The employees ceased work for several weeks. They made no money during that time. Southern employees have not yet reached the stage where they will continue indefinitely to support a union. One by one the mills reopened. More and more employees forsook their new masters for the old. The strike was settled. The employees gained nothing for their sufferings, unless more employment due to their sacrifice.

During the early stages of the development of the knit-goods industry in the South, wages were very low. It must have been partially the result of large labor supply under conditions of free competition. If such conditions prevailed today, and employers were to take full advantage of them, wages again might duplicate what happened in the past. As much of the southern labor originates from the agricultural districts, wages prevailing in agriculture must govern to some extent the price offered for that labor when it is applied to manufacturing. Farm wages in the South have always been lower than in the North owing to the influence of the negro, lack of intensive industrialization, and lower living costs. The farmer is apt to regard the wages he pays as reasonable due to the fact his cash crops, suffering from climatic influences and irregularities of distant markets, seldom bring him a high return. Whether reasonable or not, the farm wage affects the common labor wage and the two largely determine the rate which the manufacturer should offer prospective employees. It does seem that thirty cents for a 14-hour day in a knitting mill in North Carolina in 1897 would require a lot of very accurate data to prove its reasonableness.

Wages in the South and in the southern knit-goods industry have steadily increased since the beginning of the industry, but have never attained the level of wages existing in the northern states. Manufacturers tend to base their wages with some reference to the subsistence costs of their employees. Southern manufacturers have paid their employees lower wages for the same reason the Pennsylvania Railroad used to pay its telegraph operators west of the Ohio River less than those to the east—be-

cause of lower living costs. Though the operators in the Pittsburgh district received more than those in the Ohio district, they both had about the same amount left from their wages after paying expenses.

Wages can be lower in the South because food, clothing, and housing are cheaper for the employees. Food costs should be lower in the South because of its milder climate. It has a long growing season in which food can be produced. Due to distribution of solar energy latitudinally and to the variations in elevation, the region in which the knit-goods industry is located is never far from a section producing fruits and vegetables. The mildness of the climate also tends to promote easier and cheaper production of poultry, eggs, meat animals, and dairy products. While cotton and tobacco take up much space in the South, and for many years stunted its food production, there are signs of increasing activity in this field. As long as there was little demand for fresh vegetables and dairy products there was little activity in such lines. The livestock industry was represented by hogs and mules. With the growth of industrial centers constituting markets for truck garden and dairy products, the opportunity to make money in these activities is drawing increased effort. Grasses and vines which serve as food for cattle have been introduced, dairy farms developed, more farmers are keeping cattle in certain sections, and more truck farms are developing on the edges of southern cities. Proof of these statements is shown by increased numbers of canning factories, evaporated milk establishments, and storage houses being built in the South. I have lived in the South for five years and observed this trend during my study of human activities. As the demand for such products increases it will become more profitable to turn more land to such use and possible to pay for the fertilizer necessary for maintaining its production. The climate could not be much better for such activities.

In addition to the actual and potential food supplies, the nearness of additional supplies of seafood is no inconsiderable item. Good transportation in an area where there are no great centers of congested population contributes to the ease

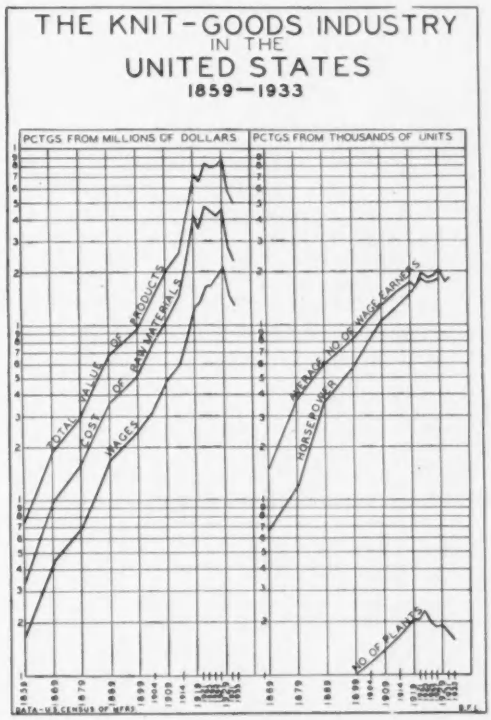

FIGURE 5.—The proportions of manufacturing costs occupied by raw materials and labor held relatively fixed positions until 1914. From 1914 to 1919 costs of raw materials increased faster than wages resulting in raw materials costs increasing their proportion of total manufacturing costs. Following 1919 wage cost proportion remained relatively stable while raw materials costs declined bringing the two items into fairly normal positions by 1929. This normal position is shown relatively unchanged in 1933. The curves showing increase in number of workers and in horsepower indicate that machines have been gradually replacing workers. In comparison with the wages curve at the left it appears that fewer workers tending more machines or more productive machines receive higher compensation. The number of plants curve shows both combinations and decrease in number of plants since 1923.

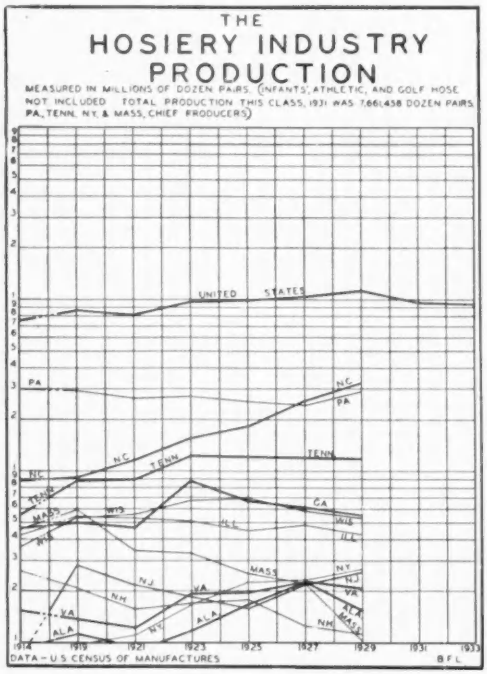

FIGURE 6.—North Carolina produces more hosiery than any other state in the United States. In spite of unsettled conditions in the industry between 1923 and 1927, North Carolina continued to increase her volume of production. Pennsylvania barely maintained her position while Tennessee remained unchanged. This may be explained by the fact that Pennsylvania has changed from production of cotton to silk hosiery. Some of her original market for cotton hosiery undoubtedly has fallen to the lot of the southern states. Another factor in North Carolina's maintenance of volume increase has been her development of silk hosiery manufacture and the manufacture of mixtures of silk, rayon, and cotton.

of distribution and the cheapness of the products to the consumers. It is unlikely food prices in the South will trend higher than those in the North because of the immense potential productivity of the region, if properly handled. Table II, calculated from prices quoted in the Consumers' Guide, shows that food prices even in the largest southern cities are lower than those in the North. Between April 24 and August 28, 1934, food prices for the United States increased 7.4 per cent. The rise in the southern states during the same period was .017 per cent. However, certain foods of the southern working man rose.

TABLE II

FOOD PRICES

The combined prices quoted per pound, per can or per dozen, of 35 common items of food, listed by the Consumers' Guide, prices in force November 6, 1934:

Manchester, N. H.	$6.315	
Fall River, Mass.	6.121	
Bridgeport, Conn.	6.450	
Newark, N. J.	6.356	
New York, N. Y.	6.250	
Philadelphia, Pa.	6.008	
Scranton, Pa.	6.138	
Indianapolis, Ind.	5.810	
Milwaukee, Wis.	5.655	
Peoria, Ill.	5.793	
Springfield, Ill.	5.797	
Average for these 11 northern cities		$6.063
Norfolk, Va.	$5.710	
Richmond, Va.	5.928	
Atlanta, Ga.	5.799	
Charleston, S. C.	5.667	
Birmingham, Ala.	5.663	
Memphis, Tenn.	5.392	
New Orleans, La.	5.457	
Average for 7 southern cities		$5.659

NOTE.—This table does not show a true picture of food prices for the southern industrial region. A large percentage of its factories are located in the inner portion of the Piedmont and in the Great Valley where agriculture, predominant, consists to a large extent of the production of cereals, fruits, and the raising of livestock. However, in the city of Durham, North Carolina, on the outer edge of the Piedmont, in a cotton- and tobacco-producing area, with a high degree of industrialization and due to other influences, food prices and rents are equal to or surpass those prevailing in large northern cities.

In Durham, North Carolina, the cheapest meat the laborer could buy—fat back—increased in price from an average of 3 to 5 cents per pound to an average of 17 to 22 cents per pound. In the North fat back is used for lard. In the South it flavors the beans. Now the southern worker can get many cuts of beef cheaper than the pork fat. He still tries to buy the fat!

In studying the cost of food in the South, the habits and tastes of the southern people must be considered. Bread prices are higher than in the North, if both sections eat the same type of breadstuff. That they do not should be well understood. The southern family likes its "hot bread," and servings of this material can be produced for far less than store bread costs. Many of the mill workers eat practically the same food that non-mill workers eat. Many also still live on fat back, hot bread, beans, molasses, and corn. There are

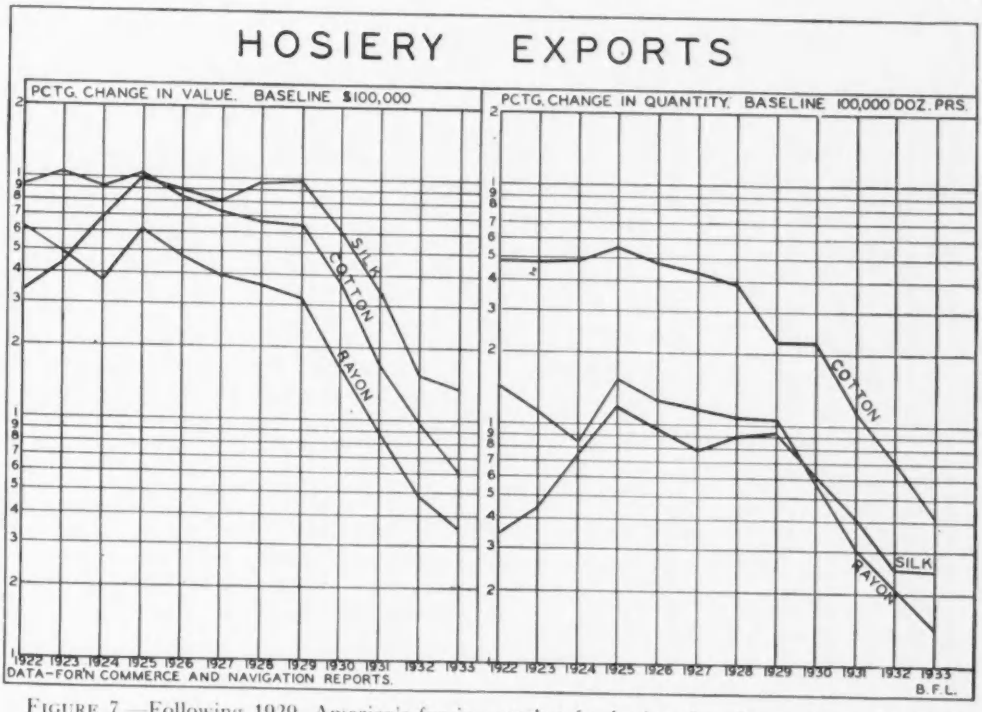
HOSIERY EXPORTS
PCT.G. CHANGE IN VALUE. BASELINE $100,000
PCT.G. CHANGE IN QUANTITY. BASELINE 100,000 DOZ. PRS.
SILK
COTTON
RAYON
1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933
DATA-FOR'N COMMERCE AND NAVIGATION REPORTS.
B.F.L.

FIGURE 7.—Following 1929, America's foreign market for hosiery has decreased to an alarming extent. The value of silk hosiery exports, which has exceeded that of cotton hosiery exports since 1925, seems to be the only one of the three classes of hosiery to show any recovery.

mill people and others who will deny this statement, yet recently when mill owners had to help their employees during periods of idleness, I know employers who distributed fat back, beans, and flour to keep their workers fed. Recent attempts to levy sales taxes on all food items purchased in North Carolina led to statements in the papers that these items should be left tax free because of their great use as food of the common people.

Clothing costs are approximately the same in the South as in the North. Work clothing should cost less for many factories producing this type of wearing apparel are located in the same town that produces the cloth which serves as their raw materials. They avoid the expense of keeping their capital tied up in stock, have very low transportation expenses upon their raw materials, and are able to gain a faster and greater return from money so saved when it is applied to the processes of manufacture. The southern employee does not have to buy as many clothes during the year as the northern worker because of climate. During very few days of the year is the weather below freezing. He does not have to invest in a heavy overcoat and heavy underwear. The length of time he uses heavier clothing determines the utility he gains from the garment. He does not have to ride miles in freezing weather to get to his place of employment.

Housing costs are low for southern knit-goods workers because many of the hosiery mills have their own company houses. These houses are clean, neat, and rent for one dollar per room per month. Electric current and water are furnished free. Fuel may be purchased from the company at cost. The knitting mills pay from $4.80 to $5.00 per ton

for their coal. Wood is often available to the worker, free if he will cut it. The total fuel costs in the South are lower than in the North because the dwelling does not have to be heated to withstand low temperatures over a long period. Many of the workers prefer to live in houses not owned by the mill companies, while many mills do not have their own dwellings. Rents for ordinary dwellings are low in the South. This cost feature is influenced by the absence of any large cities or extremely high priced land. If the worker elects to live in an apartment house, however, he may find his rent exceeding that of the North, for southern people have not yet reached the stage where they commonly live in such structures. Due to scarcity of apartments, rents are still high for such means of abode. In some southern cities a few men are said to own most of the apartment houses and to exercise their influence in preventing additional construction through credit manipulation and zoning laws. In this way they are said to be able to maintain abnormal apartment rents and at the same time create a rental market for the numerous private dwellings they own or control.

The N.R.A. codes under which southern knitting mills have been operating since August, 1933, have somewhat changed the wage situation in this country. It must be remembered southern knitting mills not only come under the hosiery code, but many of them also must be governed by codes controlling outer wear, underwear, silk throwing, and winding, and the spinning industry. Several mills with which I am familiar manufacture their own yarn, both cotton and silk, operate spinning departments, silk throwing plants, and knitting mills. Others operate spinning mills, weaving mills, underwear and outer wear plants. The effect of the N.R.A. codes has been to abolish the time-employed differential between the North and the South. In both sections employees cannot be worked longer than 40 hours per week with but two shifts of 8 hours each per day, or a total maximum of 80 hours operation per week. Southern mills formerly worked their employees from 50 to 55 hours per week and operated their plants, in many instances, 24 hours per day. This means to the southern mills a longer period each year during which the machinery stands idle. The overhead costs for plant and equipment are continuous.

With regard to wages, the southern differential over the northern wage has been drastically cut. In 1930 wage rates in some of the northern areas were approximately twice as high as in southern areas for specific operations. The tables show that wages suffered greater losses in the northern areas between 1930 and 1932 than in the southern states, thus cutting down on the wage differential between the different regions. The minimum wage rates set by the code of fair competition now show the differentials for the minimum wages to have been reduced to a matter of a few pennies per hour. This small differential refers to minimum wages only. Future wage rate tables may show that industry tends to gravitate as close to minimum wage rates as possible when those rates are fixed by law. The southern knit-goods industry still possesses a small wage differential advantage, apparently. Future developments will show whether it really can be classed as a differential, all other mill conditions in the southern industry being taken into consideration.

RAW MATERIALS

The southern knit-goods industry is located in the midst of cotton, cotton yarn and rayon yarn production. If the

southern knitting mill spins its own yarn it is able to obtain raw cotton a trifle cheaper than can northern mills. The difference in cost of obtaining the raw cotton increases as the distance of the source of raw cotton decreases. Some of the cotton can be obtained almost outside the mill doors. Other cotton is brought to the mills by their own trucks or on contract with trucking companies. Some from the more distant areas comes by rail. Transportation rates on raw cotton do not assume importance unless the cotton is selling at a low price, at which time the freight rate occupies a considerable portion of the cost. If the knitting mill does not spin its own yarn, it is never very far from spinning mills in the South and the cost of transportation is trivial. In many instances the spinning mills are within sight of the knitting mills. Most of the rayon yarn produced in the United States is manufactured south of the Mason and Dixon Line. In close proximity to the southern knit-goods industry are the rayon manufacturing plants of Rome, Ga., Elizabethton, Kingsport, and Old Hickory, Tenn., Enka and Burlington, N. C., and Roanoke, Covington, Waynesboro, Hopewell, and Richmond, Va. The production of these plants has been steadily increasing while the prices for their yarns have been decreasing or tending toward stability. The quality of the rayon yarn has shown a steady improvement. Dr. Roger Adams, president of the American Chemical Society on January 24th, this year, prophesied that new synthetic fibres would soon be placed upon the market and that they would be superior to the natural fibres, even to silk. If this improvement takes place, the southern knit-goods industry may be relieved of the necessity of obtaining raw silk from Japan. Southern knitting mills are using more and more silk each year. Much of this raw silk is purchased through New York selling agencies and reaches the mills direct from Japan. If the knitting mill throws its own silk, the skeins of raw silk, shipped from Japan, arrive at the southern knitting mill packed in cotton bags, the outside of which is covered with straw matting. If the knitting mill buys its silk already spun, the purchases are usually made from spinning mills in Pennsylvania. Some southern mills buy raw silk and have it spun in southern mills. Others buy their silk from companies specializing in the handling of raw silk and spun yarns, with offices already established in the southern knit-goods area. Transportation rates, based upon value of the commodity transported, are high. Southern mills being farther from regions specializing in silk manufacture, are somewhat at a disadvantage because of transportation charges. This disadvantage may be eliminated if the prediction concerning rayon comes true.

FUEL AND POWER

The location of the southern knit-goods industry assures it an abundant supply of coal. The knit-goods indus-

FIGURE 8.—A knitting room in a full-fashioned silk hosiery mill. This room has equipment maintaining even temperature, correct humidity, and pure air. The lighting equipment is said to supply the workers with the equivalent of two hours of actual sunlight effect during their eight hours of employment.

try of the Carolina Piedmont can obtain its coal through the gaps in the Blue Ridge directly from the mines of Virginia, West Virginia, and Tennessee. The knit-goods industry of the Georgia Piedmont faces the coal mining region of that state, Alabama, and Tennessee, while the knit-goods industry of eastern Tennessee is in the midst of coal fields. Of the 343 knitting mills in the six states covered in this paper, 180 generate a part or all of their power. Two hundred and eighty-four buy all or part of their power. Most of the knitting mills bleach, dye, and finish their products and for such purposes heat is required. The size of the boiler required for the heating processes determines to some extent how much power will be generated by the plant. Steam coal costs southern mills approximately the same as those in the North.

Electric power development has progressed to a large extent in the Southern Appalachian Piedmont and in the sections of Alabama, Georgia, and Tennessee occupied by the knit-goods industry. Topography, rock strata, a well distributed annual rainfall of 40 to 80 inches, and mild annual temperature range make feasible hydro-electric development. The millions of dollars of capital resulting from profits made upon manufacturing raw materials produced in the southern region made the development of hydro-electric power possible. Men trained in developing southern industry directed the work. Today manufacturing industries in the South enjoy an abundance of electric power throughout the southern industrial region. The rates to manufacturers for this power were less in 1932 than in the North. There have been reductions in power rates since that time. Heating costs for southern knitting mills are lower naturally due to mild temperatures which prevail.

FACTORY CONSTRUCTION COSTS

Factory construction costs are lower in the region occupied by the southern knit-goods industry because of lower labor costs, lower materials costs, and because the building does not have to be built to withstand extremes of temperature. The stresses upon the buildings, due to expansion and contraction resulting from temperature changes are less. It has been called to the attention of the writer that perhaps the greater rainfall might have some effect upon deterioration of brick buildings. The industrial area of the South has a 40 to 55 inch annual precipitation. The heavier precipitation which produces much of the waterpower falls upon the mountainous sections where there are few mills. The precipitation in northern areas of the knitting industry is from 30 to 40 inches. Thus the difference in total rainfall per year could not have an appreciable effect.

TRANSPORTATION

Due to the location of the Blue Ridge Mountains, the trunk line railroads connecting the South with the North assume, roughly, a U-shaped system. The Southern Railroad, extending through the interior of the Piedmont connects the knit-goods region with the Northeast and with New Orleans. An extension of this trunk railway passes northward to the west of the Blue Ridge connecting the knit-goods manufacturing sections of Alabama, Georgia and Tennessee with Ohio and Mississippi river gateways. To the east of the Blue Ridge, extending from the northeast to the southwest, are also the Seaboard Airline and the Atlantic Coastline railways. To the west of the Blue Ridge the Louisville and Nashville, and the Nashville, Chattanooga and St. Louis also perform their share of transporting the products

of the knit-goods industry. East and west trunk lines represented by the Chesapeake and Ohio, the Norfolk and Western, and the Virginian railways in southern Virginia aid in moving the products to the Atlantic Coast and to the interior of the country. As a result of the first railroad construction in the Southeast, many railroads were built from the coast inward with hopes of tapping the Ohio Valley. Today these lines radiate from the great U-shaped systems like spokes of a wheel providing admirable access of the southern industrial district to the Atlantic and Gulf coasts. Products of the knit-goods industry of the Carolina Piedmont find their way to the interior of the continent through numerous gaps in the Blue Ridge, via Lynchburg and Roanoke, Virginia; via the Clinchfield and Ohio Railway; and via the Southern Railway through the French Broad River gap. High Point, North Carolina, which constitutes the center of the knit-goods industry of the Southern Appalachian Piedmont, owns its own railway, the H. P. T. and D. This line gives it direct connection with five trunk line railroad systems and permits a fast schedule of freight shipments from that center.

Knit-goods producers of the South not only enjoy excellent railroad facilities but are able to use extensive trucking accommodations made possible by the thousands of miles of new highways built in the southern states during the past ten years. Many intra- and interstate trucking companies function throughout the southern industrial area. Their efficiency is demonstrated by the following examples: Freight leaving High Point, North Carolina, at night arrives in New York City the next day after being enroute 20 hours. Through service by truck from High Point to Chicago, Illinois, requires less than 48 hours. Recently a trucking company moved a complete full-fashioned hosiery mill from Philadelphia, Pennsylvania, to Asheboro, North Carolina. The cargo weighed over one and one-half million pounds and but one small piece of iron was broken enroute. The repairs for this damage cost one dollar. The shipment was made from mill to mill without additional transfer charges. The trucking lines maintain two-way services. On the outward journey from the southern industrial area they carry cargoes of

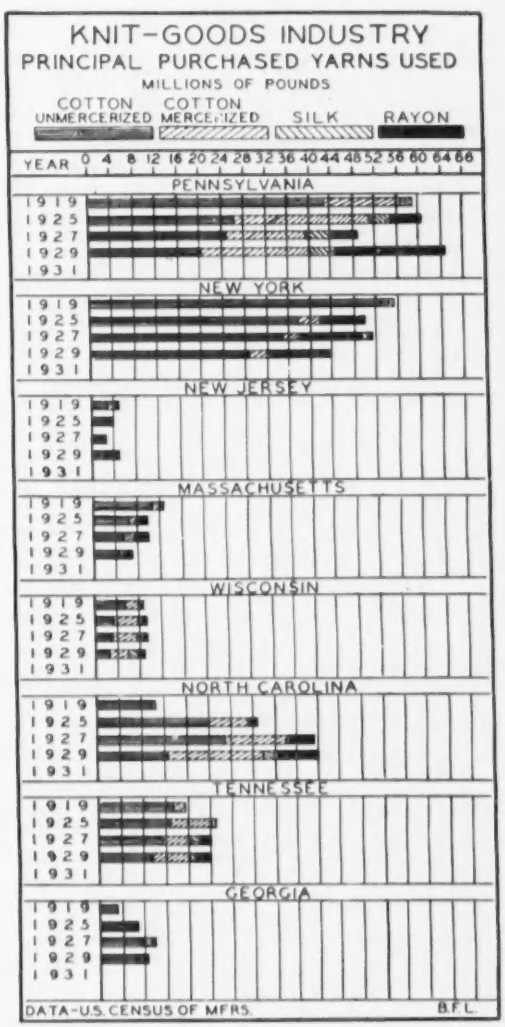

FIGURE 9.—Knit-goods manufacturers are decreasing their purchases of unmercerized cotton yarn. For the most part they are buying rayon yarn to replace it.

hosiery, other knit-goods, furniture, cotton textiles, and other merchandise. On the return trip they bring back to the factories, silk, yarns, cotton, and manufacturing supplies. Silk comes to the factories chiefly by truck. The cost of getting it to North Carolina from New York is $1.33 per 100 pounds. It cannot cost much more for Tennessee carried by the Great Appalachian Valley routes. In any event this commodity of manufacture costs more for transportation at the southern mills than it does in some of the northern knit-goods areas. While the southern knit-goods industry is somewhat at a disadvantage with regard to freight rates when comparing these rates with those prevailing farther north, the advantage of being near most of its supplies of raw materials tends to moderate this effect to some extent.

DISTRIBUTION OF PRODUCTS

Southern knit-goods manufacturers practice a variety of methods in selling their products. Some sell direct, others through jobbers and wholesalers, jobbers and retailers, selling agents, commission houses, chain stores, and direct to retailers. Many of the mills sell their goods through New York representatives, though wholesale and commission textile organizations are establishing offices right where the products are manufactured. High Point, North Carolina, has twelve such organizations. The products of the southern knit-goods industry are sold all over the United States and in many foreign countries. While the southern states afford a large market for medium and low-priced hosiery, the demand afforded by the intensively industrialized northern areas is also large. The export market, during the past few years, has tended to diminish toward the vanishing point. Manufacturers do not express alarm at this situation. Some state that operation under the N.R.A. having cut their production approximately 30 per cent, they are able to find markets for their products in the United States. The outstanding foreign markets for American hosiery are as follows: Women's cotton hosiery—Honduras, Nicaragua, Newfoundland, and Labrador, Dominican Republic, Haiti, Colombia, and the Philippines; men's cotton hose—Honduras, Panama, Philippines, and the Union of South Africa; children's cotton hosiery

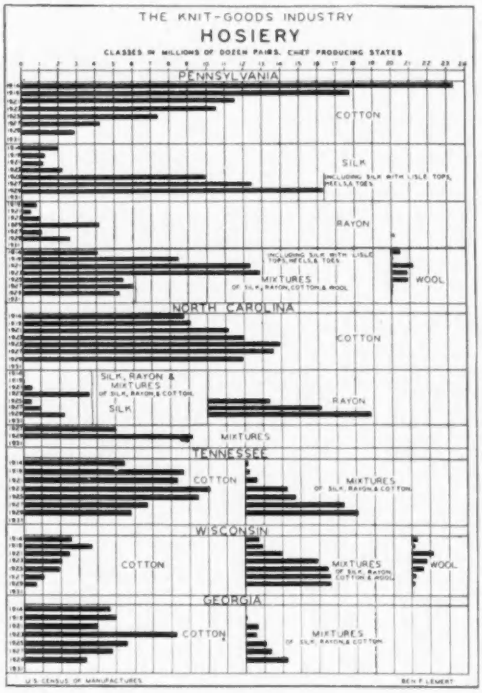

FIGURE 10.—In Pennsylvania the production of silk and rayon hosiery has displaced that of cotton. North Carolina is maintaining her production of cotton hose and developing the silk, rayon, and mixtures branches of the industry at the same time. Tennessee seems to be increasing her production of silk, rayon, and mixtures types at the expense of cotton hosiery production.

—Peru, The Netherlands, and Newfoundland and Labrador. The foreign market for silk hosiery of the seamless type is not extensive. American full-fashioned silk hosiery has a better foreign demand. Mexico, France, the Philippines, the Union of South Africa,

and Panama are the outstanding buyers, in the order named. Panama, the Union of South Africa and the Philippines buy considerable quantities of rayon hosiery consisting chiefly of men's and women's hose. These destinations represent sales for 1933 and hold true largely for 1932. Ecuador and Jamaica were large buyers of cotton hosiery in 1932, but had almost disappeared from our market in 1933. The markets for hosiery in the Dominican Republic, Haiti, Colombia, Peru, British India, the Union of South Africa, and The Netherlands also narrowed by from 20 to 60 per cent between 1932 and 1933. That of the Philippines dropped 25 per cent in cotton hose but registered a large increase for full-fashioned silk hose and rayon hose during the same period. The extent to which Japan may be able to capture our foreign markets for knit-goods is a moot question. It must be remembered she produces the raw silk, she produces large quantities of rayon, and is able to work up raw cotton very profitably. Given equal or better terms with us regarding raw materials, the cost of her labor, the second major cost in textiles manufacture, shows that in Tokyo in 1933 silk reelers received 17.7 cents *per day;* silk throwers 24.2 cents per day; cotton spinners 21.6 cents per day; hosiery knitters, male, 51.5 cents per day, and hosiery knitters, female, 25.7 cents per day. Can we hope to compete with her upon any terms while our wages maintain a minimum of 30 cents *per hour?* We cannot fall back upon an argument of efficiency of workers. Outside of full-fashioned hosiery, efficiency in the industry means machine efficiency and Japan can get the same machines we have.

STATISTICAL ANALYSIS

Analysis of representative figures for the cotton textile industry of the Southern Appalachian Piedmont show that region to be advantageous when compared with New England. The same type of analysis for the southern knit-goods industry does not show exceptional advantages accruing to this region in comparison with Wisconsin, Illinois, Indiana, and Pennsylvania, in spite of apparent favorable environmental conditions and costs of manufacture. The comparison, of course, must take into account that different quality goods are manufactured in the northern states (Table III). Taking the knit-goods industry as a whole a wider variety of higher quality products is also manufactured in some of the northern states. I have stated that the southern knit-goods industry, especially hosiery, for that industry comprises most of the South's knit-goods, experienced financial difficulty between 1923 and 1929. The results of the statistical analysis seem to

TABLE III

THE HOSIERY INDUSTRY

Quality Comparisons, 1929

Type	*Production Value per Dozen Pairs*
Cotton:	
Pennsylvania	$1.63
Wisconsin	2.92
Illinois	1.52
Alabama	1.53
Georgia	1.08
North Carolina	1.30
Tennessee	1.78
Virginia	1.53
Pure silk:	
Pennsylvania	$10.57
Indiana	11.29
North Carolina	7.94
Pure silk with lisle tops, toes and heels:	
Pennsylvania	$9.55
North Carolina	8.52
Tennessee	7.10
Rayon with cotton tops, toes and heels:	
Pennsylvania	$4.37
North Carolina	2.34
Tennessee	2.80
Silk and rayon mixtures:	
Pennsylvania	$5.84
North Carolina	3.63
Tennessee	4.09
Rayon and cotton mixtures:	
Pennsylvania	$2.19
Wisconsin	3.70
North Carolina	1.74
Tennessee	2.43
Georgia	2.28

Calculated from Quantity and Value of Production shown by 1929 Census of Manufactures.

bear out these statements, or on the other hand, the actual history lends weight to the statistical analysis. Table IV shows that wages in North Carolina occupy approximately 26.52 per cent of total manufacturing costs compared with 37.22 per cent in Pennsylvania and 33.27 per cent for the entire country. Raw materials assume 67.79 per cent, approximately, of the total manufacturing costs compared with 54 per cent for Pennsylvania, and 58.06 for the entire nation. This does not mean that in 1929 raw materials cost more in North Carolina, but that, due to low wages, raw materials bulked higher in total costs. It means that in Pennsylvania, due to higher wages than in North Carolina, raw materials must take a lower position in final costs. The same influence re-

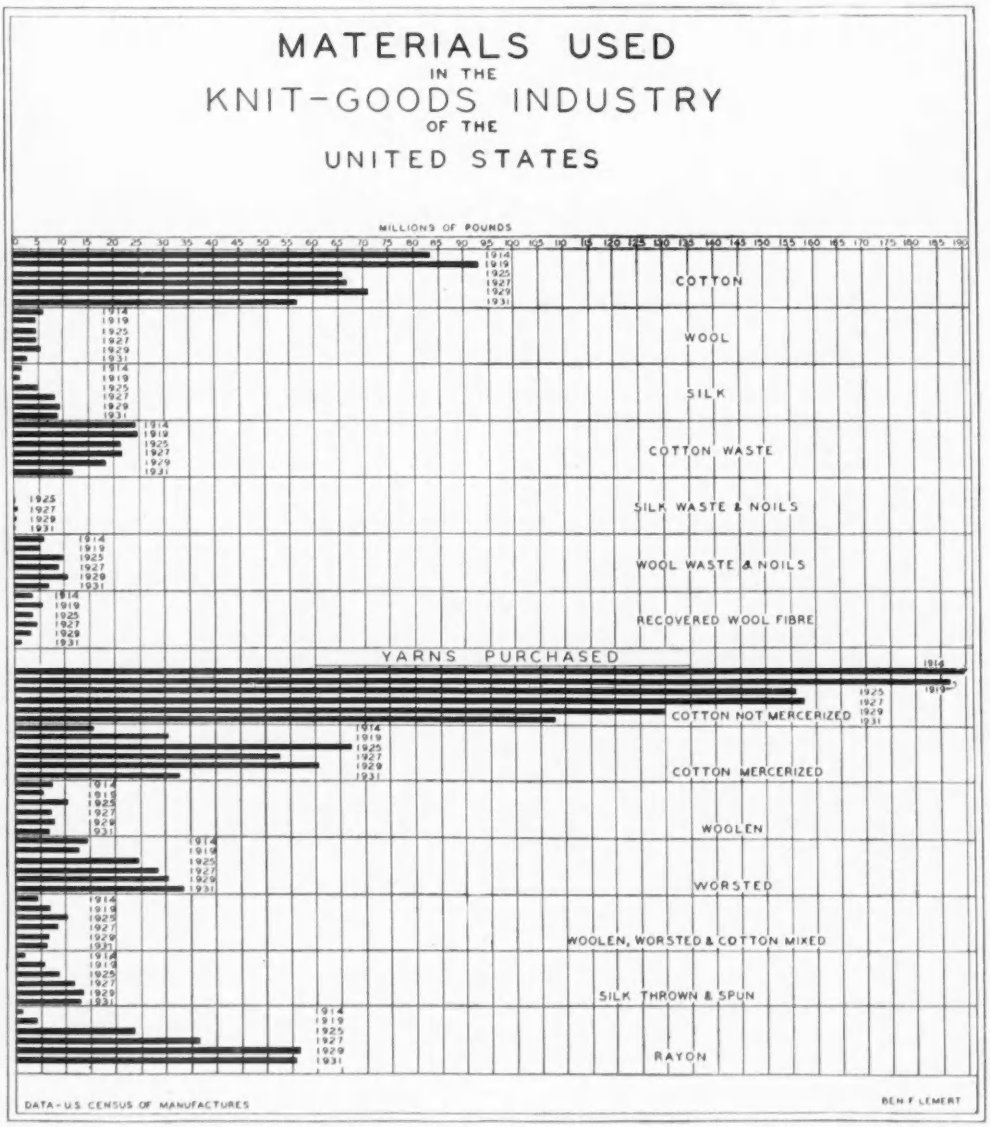

FIGURE 11.—Rayon is not displacing silk in the knit-goods industry. It is displacing cotton. Every pound of cotton yarn so displaced means a pound of yarn the cotton spinners cannot spin. It means a pound or more of cotton that the cotton farmer cannot sell, if the rayon is made from sulphite board. If sulphite board it very likely came from Canada or Europe.

TABLE IV

COST OF PRODUCTION 1929

Percentages

Classification	*North Carolina*	*Pennsylvania*	*United States*
Salaries	3.69	4.97	5.25
Wages	26.52	37.22	33.27
Raw materials	67.79	54.00	58.06
Contract work	.85	2.98	2.43
Fuel and power	1.95	.83	.99

NOTE.—The omission of the managerial expenses makes very little difference. The relationships shown here would be little changed by such an inclusion.

sults in fuel and power in the North Carolina portion of the table assuming a greater percentage than in the Pennsylvania section.

In 1919, after paying all costs of raw materials, wages, fuel, and power, and contract work, North Carolina had left 20.64 cents out of every dollar received for knit-goods, to be applied to salaries, managerial expenses, and profit; Georgia had remaining 19.72 cents; Tennessee 18.54 cents, while Pennsylvania retained 21.07 cents and Wisconsin 26.25 cents. In 1927, for all knit-goods sold, after deducting the listed expenses, North Carolina had remaining for salaries, managerial expenses, and profit, 19.02 cents out of every dollar received for products manufactured. Georgia had 22.24 cents; Tennessee 18.83 cents; Pennsylvania 21.25 cents; and Wisconsin 31.84 cents. The figures for 1929 indicate better conditions with North Carolina retaining 22.06 cents; Georgia 24.69 cents; Tennessee 21.35 cents; Pennsylvania 21.93 cents; and Wisconsin 34.90 cents. The figures for 1931, a depression year for most industries, show that the knit-goods industry in Alabama, Georgia, North Carolina, Tennessee, Indiana and Pennsylvania had more money left out of each dollar's worth of goods sold, to apply to salaries, managerial expenses and profits, than for several years previously. Table V shows that figures calculated for the hosiery industry alone, parallel those for the whole knit-goods industry as a general rule. These figures seem to indicate that the states making the highest quality of goods have left the largest proportion of each dollar's sales to apply to profit. The figures for Georgia and Pennsylvania seem to contradict this statement from opposite directions. The states making the largest proportion of their hosiery from raw materials other than cotton show the largest increases in returns, portions of which may be applied to profit. This does not hold true for Pennsylvania, the hosiery production of which state is nine-tenths other than cotton. Georgia and Alabama showed marked increases in the amount of each dollar's sales that could be applied to salaries, managerial expenses and profit, but these figures are not strictly comparable with those for

TABLE V

THE HOSIERY INDUSTRY

Portion of each dollar's worth of production that remains after paying wages, contract work, raw materials, and fuel and power. These figures represent a combination of salaries, managerial expenses and net profit.

	1923	*1925*	*1927*	*1929*	*1931*	*1933*
United States	19.87	21.37	23.32	24.54	24.16	27.11
Alabama	.....	.....	8.29	12.52	22.68	.....
Georgia	.....	.....	22.05	22.65	30.23	.....
North Carolina	.....	.....	17.64	22.47	22.73	.....
South Carolina	.....	.....	25.57	19.58	17.49	.....
Tennessee	.....	.....	19.82	22.31	23.67	.....
Virginia	.....	.....	14.88	23.70	20.15	.....
Pennsylvania	.....	.....	21.22	22.91	21.58	.....
New Jersey	.....	.....	28.49	19.22	27.86	.....
Wisconsin	.....	.....	32.36	35.41	26.92	.....
Massachusetts	.....	.....	26.67	27.84	30.57	.....
Indiana	.....	.....	35.81	35.15	43.90	.....
New York	.....	.....	33.62	27.15	22.94	.....
Illinois	.....	.....	21.30	21.26	22.17	.....

Calculated from Census of Manufacturers.

North Carolina and Tennessee since much of the knit-goods production of the former states consists of underwear, sports socks, golf socks, cotton pads, laundry pads, mops, knit fabrics, ribbons, braids, and other types. However, the figures for these states relative to the hosiery industry, as shown by Table V, do show greater chance of net profit than in the other southern states. Perhaps this increase and any increase shown in any of the states between the years 1929 and 1931 might be explained partially by Table VI. This table shows

TABLE VI

INDEXES

Average Employment, 1926—100 Index

1926	*1927*	*1928*	*1929*	*1930*	*1931*	*1932*
100	99.0	94.7	98.1	87.5	81.3	79.6

Payrolls, 1926—100 Index

100	102.2	97.3	104.3	84.6	69.9	56.5

Source—U. S. Bureau of Labor Statistics.

that between 1926 and 1932 total employment in the knit-goods industry and hosiery declined from 100 representing the basic index for the year 1926 to 79.6 in 1932. Index figures showing payrolls for the same period indicate that the shrinkage extended downward from 100 to 56.5. This might indicate that payrolls decreased faster than production or decrease in employment really necessitated. Statistics for 1933 and 1935 should throw further light upon this possible condition.

The conclusion to be obtained from this statistical analysis is that the knit-goods industry of the South may be in a very advantageous position, yet, to reach a position of supremacy having any element of stability, it must increase the general quality of its products. While the manufacture of ordinary hosiery does not require much skill, the development of full-fashioned hosiery manufacture calls for a high degree of skill and time in which to develop that skill. The analysis shows that the southern industry has been improving, but at the same time it indicates the effects of still clinging to the manufacture of cheap cotton hosiery, the market for which has been declining rapidly during recent years. Some manufacturers explain the production of cotton hosiery as due largely to extensive government buying in this class. If enough mills turn to the manufacture of higher quality hosiery in which the market seems steadily increasing, that section

FIGURE 12.—A full-fashioned silk hosiery mill. The knitting room, sewing and inspection departments are on the second floor. This industry requires lighting conditions as nearly perfect as possible. Shadows result in imperfections in a delicately constructed product.

TABLE VII

WAGES

Decrease in Average Wages in Per Cent between 1930 and 1932

Classification		Per Cent Decrease							
		Pa.	*Ind.*	*Ill.*	*Wis.*	*N. C.*	*Tenn.*	*Ga.*	*Ala.*
All workers	(M)	30	38	..	34	16	9	19	39
Boarders	(M)	30	*20	10	25	28	7	30	34
Folders	(F)	34	21	*3	26	24	3	10	10
Inspectors	(F)	20	18	14	26	20	*3	18	39
Knitters, full-fashioned									
Footers		48	40	..	38	21	..	..	..
Leggers		50	41	..	36	20	..	..	..
Knitters, seamless									
Automatic	(F)	24	..	19	34	14	24	..	..
Rib	(F)	40	..	..	16	..	..	..	..
Transfer	(F)	32	..	23	16	8	20	1	36

* Increase.

These occupations are picked at random from the complete list of occupations to show the inequality of wage changes between states and between sections.

of the industry should enjoy greater advantage and at the same time fewer mills producing cotton hosiery might enjoy an advantage in that decreased production would find their product in greater demand even though the total market had declined.

CHANGES IN THE KNIT-GOODS INDUSTRY

In 1913, Georgia had 28 knitting mills; North Carolina, 66; South Carolina, 8; and Alabama, 7. In 1933, North Carolina had 168 knitting mills; Tennessee, 74; Georgia, 52; Virginia, 23; Alabama, 17; and South Carolina, 9.

North Carolina has eight mills making underwear, gloves, and other knit fabrics; Virginia has six mills producing underwear; Georgia has 14 mills turning out a wide variety of knit-goods. Six of Alabama's knitting mills are making knit fabrics, mops, underwear, and other classes of goods. Tennessee has seven mills manufacturing underwear and knit-cloth.

About 10 of North Carolina's knit-goods mills are owned by interests outside the state. The approximate figures for mills included in this category in the other southern states included in this discussion are: South Carolina, 2; Virginia, 2; Georgia, 4; Tennessee, 4; and Alabama, 8. The southern knit-goods industry is southern-owned and developed.

A large number of the knitting mills in this section of the United States are of modern construction. Most of them carry their products through all stages of manufacture including bleaching, dyeing, and finishing. Some of the newer mills have laboratories for testing their products. Some of them are air conditioned and lighted throughout by lamps radiating ultra-violet light. This lighting arrangement is said to provide the employees with two hours of actual sunlight effects during their eight hours of employment. The machinery for the most part is strictly modern for the operators of these knitting mills are missing nothing that will promote efficiency of their plants. The full-fashioned silk hosiery production is rapidly spreading throughout the southern knit-goods section and the mills are as rapidly as possible taking over all stages of such production from the point when the bales of silk reach their factories from Japan. Some of the knitting mills own and operate their own box factories, manufacturing their supply of fibre board cartons and the pasteboard boxes which contain the hosiery. Included with these additions they also own and operate their own label printing plants.

As usually occurs when any industry

develops in a region, it attracts many dependent and independent industries. In the southern knit-goods region factories manufacturing and repairing knitting machinery are springing up. Other factories of like nature are those making containers, labels, bleaching, dyeing, and finishing and mercerizing plants. North Carolina now has 29 bleaching, dyeing, and finishing plants; South Carolina, 14; and Georgia, 11. Where textile products formerly were sent north to be finished, manufacturers inform me that northern goods are now finding their way to southern finishing mills. The development of dye and other chemical industries in the southern industrial district is increasing. Many factories using the products of the knit-goods industry and the cotton and silk textile industries of the South are locating here that they may be as close to their raw materials as possible. The list of industries which have been established in this industrial district to service its industries and the people engaged in those industries is a long one and is rapidly increasing.

The southern knit-goods industry is spread over a large area occupying considerable portions of the six states included in this paper. Due to the inherent nature of the region and its contemporaneous industrial development, the knit-goods industry may be said to be decentralized. However, like the cotton textile industry, the region contains spots of centralization in which the industry may still be said to be decentralized if compared with northern industrial areas. The areas of greatest concentration are from Durham to High Point and Thomasville in the central Piedmont of North Carolina; in the western Piedmont and Coosa Valley section of Georgia, and in the Valley of East Tennessee from Chattanooga and Cleveland to Knoxville. The reasons for these concentrations are obvious. Once knitting mills became successful in these three regions, like the rubber industry of Akron, Ohio, or the automobile industry of Detroit, they attracted other knitting mills and capital from other local industries into the knit-goods business. High Point, North Carolina, has become such a knit-goods center, the manufacturers are promoting a Hosiery Exposition for the continuous display of their wares. This exposition would be similar to their Furniture Exposition.

Many of the southern knitting mills are small. Others are very large. Durham, North Carolina, has a very large mill. Winston-Salem, North Carolina, claims the largest underwear plant in the country. In several instances a number of mills are combined under one ownership. One knit-goods organization operates 15 mills. Another has 16 mills, operating more than 250,000 spindles, hundreds of knitting machines, maintaining a finishing plant, and producing cotton and silk cloth, and cotton, silk, and rayon hosiery. In several cases the directorates of the mills interlock in that the secretary of one group will hold the position of president of another and treasurer of still another group. There have been consolidations and combinations and some of the mills are owned by furniture manufacturers, tobacco manufacturers, and cotton textile producers. In such manner is southern capital distributed. The capitalization of these southern knit-goods organizations ranges all the way from $10,000 to approximately $10,000,000.

About 53 per cent of the total capital invested in the southern knit-goods industry is invested in North Carolina; approximately 28 per cent in Tennessee, and 12 per cent of the total in Georgia. The construction of new mills continues.

MINNESOTA FOREST SITUATION

George H. Primmer

MINNESOTA includes 20,200,000 acres designated forest land (Figure 1). Agricultural clearing and other removal reduced by 42 per cent a wooded area early approximating 38,000,000 acres. Another 2 to 3 per cent classifies as nearly waste land, unfit even for growing trees. Of present forest area a commercial stand covers 20 per cent, and young growth promising commercial value close to 65 per cent, leaving about 15 per cent under the heading "bare area." Marketable forest stands consist largely of cordwood and pulpwood stock, trees of sawlog size dominating somewhat less than 40 per cent their total surface.

Minnesota still contains more than half as much forest area as it had in its pioneer period. Estimates place original stand and amount sawed to date each at 70 billion board feet. Recent calculations indicate that, besides nearly 50 million cords of smaller material, the state now could cut but from 3 to some 8 billion board feet of saw timber. Computations showing present total annual increment slightly in excess of entire yearly cut lack reassurance. Current commercial production falls far short of supplying demand for local consumption.

Wisconsin, likewise, grows wood in excess of current cut. Hardwoods, spruce, and hemlock constitute nearly all the commercial cut while aspen, jack pine, and scrub oak comprise nearly all the growth. A recent estimate indicates a use of but 12,000 cords of aspen while 2,500,000 grew. Spruce growth replaces but approximately one-eighth annual removal.

In recent decades residents of the state purchased one-third, then one-half, and by 1928 as much as 85 per cent of their lumber needs from other states, paying, including freight, 20 to 30 million dollars yearly therefor. Foresters contend that Minnesota readily could substitute for this anomalous condition eventual production on its own lands of three times total state lumber use. Quality depletion shows in the small amount, but 2.1 per cent present stand, of white

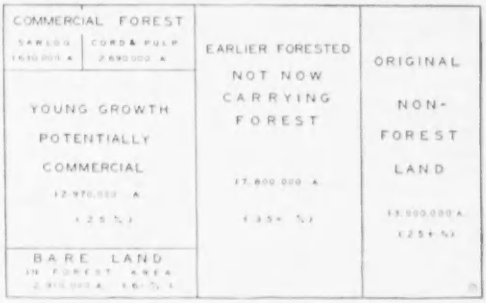

FIGURE 1.—Ratios of subdivisions to entire area of graph equal those of parts of Minnesota to entire state. Though now carrying forest on nearly 40 per cent of its area, slightly more than 3 of the 40 per cent classes as sawlog and somewhat more than 5 as cordwood and pulpwood material.

and Norway pine now available, while trees of aspen type, 51.3 per cent stand, produce wood sixfold their annual cut (Figure 2).

CONTROL OF MINNESOTA FOREST LANDS

Ownership or control derives significance from its influence upon management and utilization. Private holdings not long since comprised more than three-fourths of Minnesota forest, but inasmuch as some owners ceased tax payment their holdings gradually revert to the state. A constitutional amend-

FIGURE 2.—Stand of Aspen in Northeastern Minnesota. Some calculations indicate a forest growth increment for the state a trifle larger than annual harvest. Increment, however, consists largely of aspen type trees which furnish but a very small share of the harvest.

ment followed by legislation of 1931 provided for special classification and a yield tax for forest holdings but no county board has yet granted an application for formation of an "auxiliary forest." Farm woodlots, perhaps one-sixth within the hardwood zone, total nearly 4,750,000 acres, averaging 26 acres per farm. In a recent year, they contributed well above $10,000,000 to farm incomes. Comfort, aesthetic values, wood for local use, and, in some cases, soil conservation, accrue from farm holdings. Minnesota farmers plant 100,000 trees annually in windbreaks and shelter belts.

Federal forest holdings in Minnesota rose 50 per cent above the 1,000,000 acres of 1929 and plans now maturing indicate an even greater increase. Chippewa forest, for example, includes the original area, the added purchase unit, and a recently approved extension (Figure 3). State forests date from a 1914 amendment. Before the current decade, but five small forest areas, a total of less than 500,000 acres, were listed as state owned. Recently, thirteen areas embracing 3,583,000 acres received state forest designation. Consolidation plans have already increased state titles from but slightly more than one-fifth to two-fifths of the included acreage.

State ownership eventuates through purchase or through reversion at expiration of long redemption periods now legal for tax delinquent lands. More than one-half of the private holdings within state forest boundaries now stand delinquent with a large portion quite likely to revert. Near Mallard, White Earth area, delinquency reached two-thirds of all private lands. Part of St. Louis County Work Farm and areas such as Magney Park, Duluth, administered according to good forestry practice, probably point the way to more forest under control of the smaller political units. The state commissioner of forestry recently predicted that likely more than half the forest and marginal and sub-marginal agricultural land would fall into public ownership, preferably state and federal.

DIRECT RECREATION VALUE OF FOREST

Adaptability of any Minnesota forest area indicates proper management plan. Some areas particularly invite recreation use. A reforestation commission reporting to the 1928 legislature suggested probabilities of but four to six per cent income from investment in forest lands producing but wood. Even their low income estimate depended upon reasonable insurability against fire, wind, insect, and disease losses. Most Minnesota forests give little promise of great profit from wood alone. However, from a combination of their utilities, of which recreation values in some cases

lead, wooded areas of the state deserve maintenance and enlargement. For a great acreage, forests represent the highest and most productive long-time use for permanent good of greatest number of persons.

For enhancing recreational values, timber stands bordering lakes and interconnecting streams and along highways remain uncut, though workers remove unsightly material from some. Dozens of landscape projects involving roadside planting by civic organizations increase aesthetic appeal to vacationers. Numerous public camp grounds, for the most part including spring water, invite travelers in both state and national forests (Figure 4). Lake shore lands under lease provide sites for tourist hotels, cottages, and summer homes. Permits to use national lands in one area increased almost 80 per cent in the past five years. In addition to Itasca, Scenic, Jay Cooke, and St. Croix forested state parks, another recently improved tract of 650 acres includes the five falls by which Gooseberry River tumbles down to Lake Superior. A CCC company supervised by the state park division of the National Park Service worked much of the summer of 1934 preparing Gooseberry Park for visitors.

Road building policies point toward making the larger number of scenic areas open to automobilists. A road extends from Lake Superior at Grand

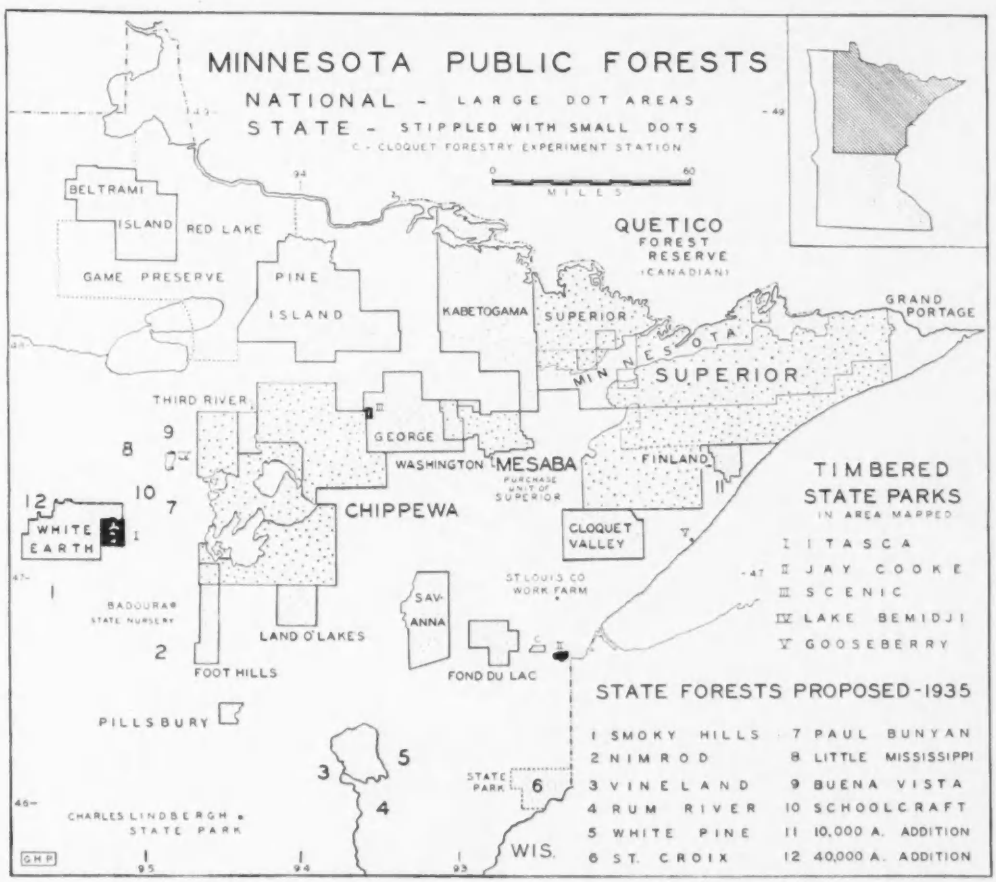

FIGURE 3.—No single simple map clearly indicates ownership of all public forest areas. State and federal forests, in some instances, coincide, and in others, overlap. Private farm and forest tracts intersperse publicly-owned areas.

Marais to international boundary waters at Seagull Lake; a similarly-situated road connects Duluth with Crane Lake, Kabetogama Lake, and Rainy River outlet of Rainy Lake at International Falls. From Hovland, a road reaches McFarland Lake and a much longer route through Finland and Ely extends by way of Buyck to a connection with border waters. The route between Ely and Buyck, carrying the deserved designation "Forest Trail," makes available fishing lakes which are almost as nearly virgin as the encompassing woods. Many other roads from Minnesota prairie areas penetrate or extend through its forested section, much to the convenience of vacationers seeking recreation.

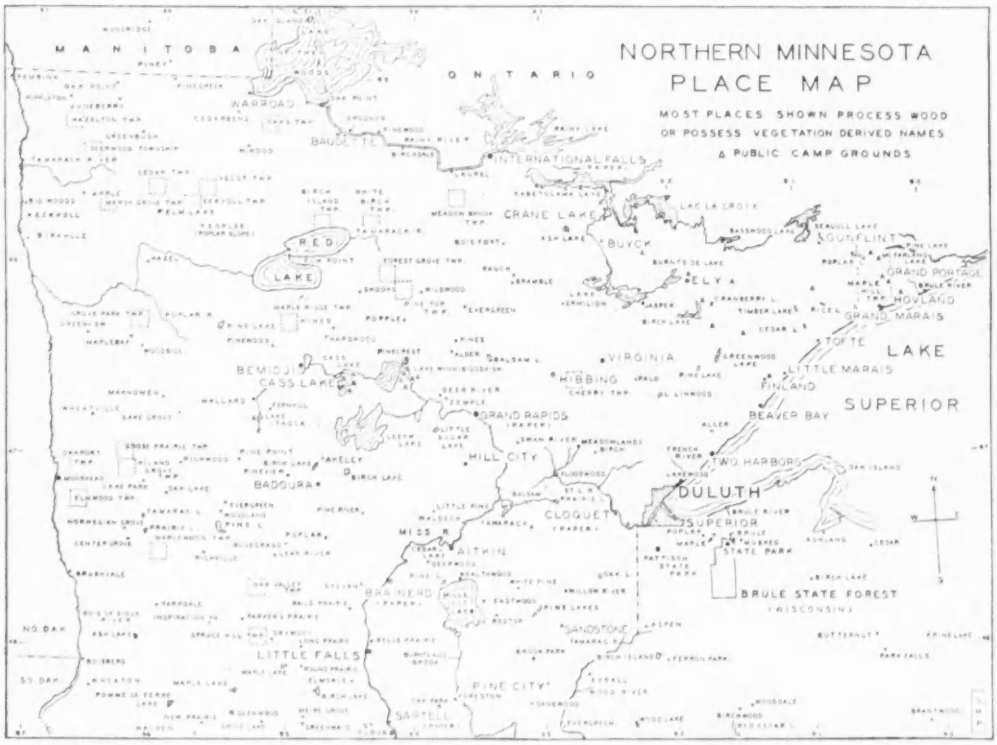

FIGURE 4.—Vegetation-derived names, for the most part, suggest local native plant life. Two names came directly from men, another possesses no local significance, and a third does not show on modern maps. Palo (Finnish), Brule (French), and Burntland carry meanings almost identical. Birkholz, Ekdall, Pembina, and others derive from other than English languages.

Superior Forest, on the other hand, contains a "Wilderness Area" of more virgin woodland extending from lake shores to beyond range of vision (Figure 5). They desire an area for those to whom white birch settees, cosy, screened cabins, and handy, stone-edged paths make negative appeal. Decibels of sound, in such secluded forest district, measure but one-fifth to one-fourth as much as noises of ordinary home activities. Minnesota forests contain a diversification of recreation areas such that

only the over-fastidious may not somewhere find pleasing surroundings; recent estimates placing tourist care fourth in Minnesota income sources reflect one phase of their economic value.

FISH AND GAME PROTECTION

Forest cover for fish, less obviously necessary than for game, shows equally desirable in Minnesota. Forest fires decrease trout in destroying peat and tamarack bogs whence trout streams emanate. Propagation requires cool water, 50 degrees or lower, trout soon dying in tepid and warm water (Figure 6). Water temperatures rule high after trees, moss beds, and springs supplying cold water, disappear along stream channels. One stream cascading down Lake Superior north shore, early this century famous for brook trout, now yields trout of no kind, its pools in midsummer rising to 86 degrees F. Another stream passing through tamarack swamp from thick beds of sphagnum moss, a nearly ideal situation, measured but 38 degrees F. French River grew so warm some summers ago as to necessitate a new source of supply for tanks of the state fish hatchery near its mouth. An intake pipe extending to fifty-foot depth taps Lake Superior water, of slightly less than 40 degrees constant temperature, for midsummer use. Restoration of vegetation cover can solve overheating problems for other areas less happily situated.

Cash income based upon fish and game not only comes annually but also more quickly than that from trees. Plans for Minnesota forests include management to serve game birds and other game animals. Continuous conifer stands do not provide conditions most conducive to game increase. Moose and caribou thrive in forest; deer require a lesser covert; and grouse respond to tamarack, alder, and other swamp growth. Best game forest consists in part of but shrubs and includes interspersed open meadows. Many sections of state-owned woodland constitute public shooting grounds; other areas form game refuges, sanctuaries for wild life increase. The state forester estimates 150,000 deer and a take of $1,000,000 in fur animals annually possible without material forest damage.

Animal protection carried to extreme limits defeats itself. Beaver, multiplying without restriction in Itasca State Park, ate nearly all aspen within four hundred feet of lake shores. Food

FIGURE 5.—Norway Pines on Shortiss Island, Lac La Croix. Vegetation and utilization typify the near pristine canoe country from which nature and custom combine to exclude wheels. (Courtesy Minnesota Arrowhead Association.)

scarcity means that few beavers now live in the park. Itasca deer, unduly numerous under complete protection, allow but few young white pines or Norway pines to attain heights as much as one foot. Since the seedlings form a preferred winter food, deer nip off their tops projecting above snow. Without reduction in number of deer, pines, major vegetation attraction of the park, soon will give way to climax forest of the region, largely balsam fir and spruce.

In Chippewa National Forest and vicinity unusual multiplication of rabbits renders the future of pine seedling plantations precarious. During the current winter and that preceding, forest

FIGURE 6.—Trout ascending Lester River. Watersheds of Lake Superior north shore and other streams, yet retaining natural vegetation cover, provide most hospitable habitats for game fish.

service employees informed hunters concerning best shooting grounds. Indian service workers distribute slain rabbits to needy Cass Lake Indians.

CHRISTMAS TREE INDUSTRY

Minnesota, though its forest service recommends living trees for lawn decorative use, holds little share in the rabid conservation viewpoint that cutting trees for Christmas purposes constitutes a major forestry crime. In some cases it means but salvaging tops from trees cut for pulp, or using small branches which machines wire into long strands for festooning streets and large halls; in other cases it but leads to desirable release thinning, not a detriment but a decided improvement to a forest; and, where selective cutting of a stand prevails, a sizable income may accrue from annual harvest of Christmas trees alone. Interested persons already discuss possibilities of plantations to satisfy future demands.

The state cuts about 1,500,000 trees each season between early October and mid-December or later. Approximately one-third supplies Minnesota, the other two-thirds serving Mississippi Valley, though some trees travel as far east as Buffalo. Cutters grade trees for size, height, and shape, and arrange them in compact, tagged bundles for shipping. Local areas receive truck or trailer shipments and in recent years some Iowa consignments go by truck. Trees reach distant points largely on flat cars or in box cars.

Black spruce, typically bushy and in nearly pure even-aged stands, supplies more trees than either white spruce or balsam fir. Aroma and superior needle retaining capacity further balsam sales.

Promiscuous, unregulated cutting long since all but disappeared. Laws restrict removal from tax delinquent land and from any land without proper authority. Persons transporting Christmas trees carry permits containing legal description of lands whence they came and written consent of land owner to remove trees therefrom.

SCIENTIFIC APPROACH TO FORESTRY

Since 1898, Minnesota has offered technical college training, more recently including graduate work, to develop forest specialists. Freshmen students of forestry division, state university, work in an experimental nursery and elsewhere at Itasca park field station during summer camp sessions. Forestry, entomology, and plant pathology students use areas in the same park for research.

University of Minnesota maintains a forest experiment station on a well timbered three thousand acre tract near Cloquet. Its several hundred test plots give state foresters opportunity to work on pressing local problems of their choosing. Junior students use the station as a forestry laboratory.

The federal forest service located Lake States Forest Experiment Station at University Farm, St. Paul, in 1923, to coöperate with the state division of for-

estry. Its researches cover more than Minnesota problems, extending into Michigan and Wisconsin as well.

Three experimental forests in Minnesota, totalling some 5,000 acres, serve as federal field laboratories. Cutfoot, near Deer River, contains largely Norway and jack pine; Pike Bay, close to Cass Lake, comprises chiefly hardwoods with aspen most conspicuous; and Kawishiwi, southeast of Ely, gives a sample of the eastern Mesabi area, composed largely of spruce and jack pine.

FIRE PREVENTION AND CONTROL

Minnesota loss from forest fire in a five year period recently ended, with almost 275,000 acres per year burning over, surpassed $800,000 annually. Rangers extinguished an average of 1,160 fires each season. Averages of incipiency indicate for smokers, 72; campers, 104; and land clearing and brush burning, 193. These and some other causes may be classified as preventable. Estimates, including allowance for contributed labor, indicate an annual obligation of the state of about $1,500,000. Rainfall deficiency in ten of eleven years just past, totalling 49 inches for the period, partially explains why burned over acreage averages so many times the desirable minimum of one-tenth per cent.

A gross area approximating 26,000,000 acres of northern Minnesota comprises eighteen state ranger districts; Chippewa Forest contains five, and Superior, six, districts. State rangers and assistants make up a permanent force of about eighty men, increased to some two hundred or more in emergencies. During fire seasons, mid-April to late October, two to seven patrolmen and

FIGURE 7.—Cloquet. The typical large commercial sawmill, such as shows in middle background, nearly disappeared from Minnesota forested area. Few regret its passing for it symbolizes the one-crop "mining" policy of forest exploitation. In the short season available, higher latitude United States areas vision maximum profit from marketing many trees long before they attain sawlog size. Besides, modern manufacture provides forest communities much more labor than just sawing logs into boards. In the long buildings occupying the foreground Cloquet workers fabricate wallboard, "nu-wood" in various forms, "tuff-wood" in three densities, and "balsam-wood."

FIGURE 8.—Pulpwood awaiting processing. Logs shown lie afloat on Mississippi River which carries them to Grand Rapids paper mill of which the stack rises in left background. Cloquet River formerly floated logs to Cloquet but gave way to train and truck haul. Power developments handicapped river use, while remaining timber stands nearer railways and highways than to the upper river or its tributaries.

tower watchmen work in each district, while patrolmen of railway and lumber companies coöperate with district rangers.

Superior contains 14 observation towers with more contemplated; probably 31 additional towers will supplement the 14 in the original Chippewa area; state forests now include about 110 of the 130 steel towers planned. Tower observers notify rangers of fires in average areas of about 100,000 acres. Placing towers on such natural features as Jasper Peak, monadnock south of Lake Vermilion, and the giant 60-foot-high esker on St. Louis County Work Farm increases visibility. Within one year Emergency Conservation Workers erected 13 state towers along with other epochal work in fire prevention, detection, and control. Transport routes have received such improvement that equipped fire fighters, dispatched from central depots, may reach many areas within the hour they hear a fire report.

Laws provide that township fire wardens protect property against fire and issue burning permits under proper weather conditions. Railway locomotives must carry spark arresters on stacks and have ash pans fitted to catch all cinders dropping through grates. Patrol cars following trains at times of greatest fire hazard and supervision by a forest officer of burning old ties and right-of-way show justifiable results. Forest officers may commandeer automobiles, equipment, and tools as well as services of any available able-bodied person for use in fighting fires.

PINE BLISTER RUST

Minnesota forest employees do much work to counteract or prevent evil effects of storms, insect and other pests, and tree diseases. One white pine disease merits attention. In less than twenty years from its known inception, rust spread over much of the eastern half of the wooded area. Though some earliest infested trees live still, the rust leaves its marks. Twenty years forms so short a part of the life of a large-sized pine as to make the disease a serious menace. Since it spreads from tree to tree only indirectly through an intermediate host, control methods seemed obvious.

Five years' work demonstrated effec-

tiveness of eradicating currants and gooseberries among or within 900 feet of pine stands. Intermittent and comparatively small scale operations, the only sort carried on until recently, suggested possibilities but failed of conclusive results. In their first year, emergency conservation workers covered more than 50,000 acres in blister rust control treatment. With the large amount of labor now available further spread of rust should receive definite check.

FOREST PLANTING PROGRAM

Studies made in Minnesota forests indicate that but from 10 to 25 per cent of the entire wooded area cannot produce a crop unaided for many decades and so should be planted to seedling trees. Other students of the problem suggest that except for as little as 4 per cent of the acreage, natural reproduction will prove satisfactory.

The state propagates stock used for planting in state parks, state forests, along roadsides, and on grounds of state institutions. In 1933, its nursery at Badoura matured some 3,500,000 seedlings, many of which emergency conservation workers planted. Annual capacity of Badoura nursery now approximates 5,000,000 seedlings. Minnesota maintains two transplant nurseries to keep planting stock always available for adjacent forests. Side Lake ranger station transplant beds in George Washington forest hold 200,000 trees.

The state developed a 1,000,000 capacity nursery at Cloquet forest experiment station; and at Itasca Park an experimental nursery, already credited with production of hundreds of thousands of both conifers and hardwoods. The demonstration forest on the work farm of St. Louis County found an associated nursery advisable. In short, all agencies embarked upon forest reconstruction on any considerable scale include artificial reproduction and planting of seedling trees as part of their activities.

National forests contain by far the greatest propagation facilities. Development starts in spring of 1935 on a nursery for Superior, heretofore supplied with seedlings from elsewhere. A site of 40 to 50 acres of nearly level sandy loam, with water available for overhead sprinkler irrigation, would meet approval. Such a tract could have approximately 50,000,000 seedlings growing at one time. Chippewa forest includes two nurseries. One of 19 acres at Cass Lake can furnish annually some 12,000,000 seedlings, chiefly white spruce; the other, Lydick nursery, approximately 73 acres, can mature each year some 41,000,000 two-year Norway, jack, and white pine seedlings. For the most part Chippewa stock replants Chippewa and Superior forest areas, but some goes to other federal lands in Lake

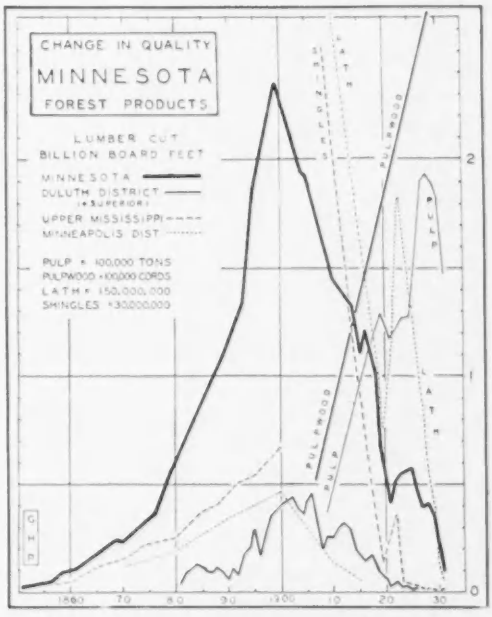

FIGURE 9.—Along with sawed lumber, lath and shingles show similar decline. Pulpwood and pulp grow more significant with increasing scarcity of saw timber.

States region. Settlers derive supplementary income from sales of collected seed cones to public nurseries.

As yet, the replanting of Minnesota forest lags far behind the fire loss. With increasingly effective fire control, actual enlargement of wooded area seems possible, though not imminent. Since each bare acre requires 1,000 or more seedlings, a total of but a few square miles in seven state forests artificially acquired tree cover in 1934. National forest planting programs, especially for Superior, show larger than ever before. Plans for Mesaba unit include a "tree refrigerator" or seedling storage room for 500,000 trees. Keeping seedlings dormant longer lengthens spring planting seasons from 20 to 40 days. In 1934, Chippewa forest planted area increased about 1,000 acres. The supervisor considers a 5,000,000 capacity cold storage room and expects to replant 4,000 acres in 1935.

FIGURE 10.—Pulpwood stockpile. The wood shown, rossing having removed its bark and sawing reduced it to appropriate lengths, lies ready for grinding. Rainy River, flowing by to the right, actuates the pulp stones in International Falls mills.

SHIFT FROM LIQUIDATING TO SUSTAINED YIELD FOREST MANAGEMENT

Northeast from Grand Marais, including 43,595 acres state land of which somewhat more than half carries mature timber, lies Pigeon River working circle, type for future developments in state forests of Minnesota. Along with some attention to recreational possibilities of the area, management plans point toward a permanent yield of 3,000,000 board feet annually, sufficient to support a local manufacturing industry. For the next forty years of utilization, calculated cuttings total some 16,000,000 cubic feet. By the end of the period, regrowth, carefully guarded from fire and other hazards, should place the forest on a continuing cyclical cutting system of sustained yield.

Superior national forest logging plans contemplate endless selective logging on a fifty-five year cycle. In successive eleven-year periods, each of its five areas contributes its marketable material. Contractors, whose railway penetrates the subdivision with the most mature timber, now enjoy an extension in cutting time as they await more auspicious market conditions.

Chippewa national forest represents something near a forester's ideal of management already in full stride. Its plan for cyclical harvesting on a basis of sustained yield, aided perhaps by the numerous consuming markets along its margin or within easy reach, long since passed from the theoretical into the practical realm.

FOREST PRODUCTS MANUFACTURE

Cloquet, a leader in processing wood, illustrates admirably the wide range of forest products which Minnesota towns manufacture. Knife Falls of St. Louis River, which descends 97 feet within present city limits, attracted the first sawmill settlement (Figure 7). Rebuilding after its 1918 fire, alongside remnant paper plants and sawmills, Cloquet acquired fame for its nearly complete utilization of trees, including species earlier classed unmerchantable. Rather than send but 25 per cent of a tree to the ultimate consumer as useful

products, Cloquet planned the full elimination of waste in manufacture. With the decline in the quality of the tributary forest, its factories decreased the use of white and Norway pine and fashioned 85 per cent of their output from spruce, balsam, jack pine, birch, tamarack, and poplar.

Sawmill slabs and trimmings provide box factory material. Small pieces glued together make shooks of desired size, in general, shipped before assembly into boxes. Non-lumber jack pine, birch, and poplar join with spruce in supplying the paper mill. Almost any wood scrap serves for producing the synthetic lumber commonly designated as wallboard. Shredded balsam fiber cemented between sheets of asphalted kraft paper forms an insulating fabric suitable for use in Antarctic buildings. It efficiently keeps heat from interiors of the many refrigerators made in Cloquet.

White birch discolors in summer. Hence the manufacture of articles of bright appearance proceeds in winter with polishing deferred until summer. Cloquet factories can make 600,000 clothes pins daily, some of conventional straddle type and others of two pieces of wood united with wire drawn in the Duluth plant. Spatulas for physicians' use may take form at the rate of a quarter million, throat swabs at half a million, while other machines spew forth toothpicks to a grand total of 62 million in a day.

In 1905 the Diamond Match Company began the preparation of white pine blocks which were sent east to supply other plants. Thirty years later, Cloquet used its influence to have the Minnesota legislature memorialize Congress to maintain a high tariff against foreign match competition. Cloquet community loudly protests alleged purchases by the state of Minnesota of matches made in Sweden and in Russia. Such practice tends to jeopardize its own match industry which furnishes at least part time employment to about 1,000 persons and spends more than $100,000 annually for raw materials purchased from local farmers.

Paper mills at Cloquet and elsewhere in northeastern Minnesota likewise fear foreign competition (Figure 8). The state Senate recently adopted a resolution urging upon Congress an adequate tariff on print paper and pulp. In recent years, Scandinavian pulp in small cargoes entered Minnesota by way of the St. Lawrence-Great Lakes route.

COMMUNITY REJUVENATION

Hill City contains the site of the dismantled National Woodenware plant earlier manufacturing tubs and other wood products for Armour and Company. Increasing difficulty of obtaining timber from a reasonable distance constituted a significant factor leading to discontinuance of operation. Proper management of the once well-forested territory in the vicinity could have made possible from annual production the permanent activity of such a plant.

During the census decade 1920–1930 Hill City lost 44 per cent from its population. State commissioners refused permission to cease train service on the twenty-mile branch line joining the town with the Great Northern at Swan River. Nevertheless, Hill City now well exemplifies a type of decadent wood-using community which Minnesota forests no longer support as in an earlier period.

Other places experiencing heavy population losses within the latest census decennium include Spooner, 64 per cent; Zemple, 42 per cent; Akeley, 40 per cent; Richville, 36 per cent; Cass Lake, 33 per cent; and Deer River, 21 per cent. Such a noticeable and significant decline reflects narrowing possibilities of basing livelihood upon forest products.

Within the same period a number of unorganized townships lost much greater fractions of their population than the towns listed, in one case 98 per cent, leaving 36 square miles almost depopulated. Old style logging methods leave permanent support for but very few persons after large crews harvest all salable timber.

Current Minnesota forestry methods point to numerous communities of 25 to 75 families deriving income from cultural, protective, and logging activities within timber cropping areas. Towns with wood-using industries on margins or included within forest areas begin to feel more certain of raw material supply (Figure 10). Increase of population for some and a nearer approach to stable population for all logically follow the reforestation and the sustained yield management of their tributary areas.

SMALL FARMING ON KAUAI: HAWAIIAN ISLANDS

John Wesley Coulter

THE Hawaiian Islands are outstanding for the production of sugar cane and pineapples by the plantation system of agriculture. But small farming is also carried on actively on all the larger islands. That method of farming is of special interest because of the nature of the problems which confront the farmers and because the degree of success seems to correlate with the racial ancestry of the people who engage in it. In the Kalaheo district on the island of Kauai, small farming, in many ways representative of that in general in the islands, is carried on. The outstanding difference is that many of the Kalaheo farmers do not depend entirely on their land for a living.

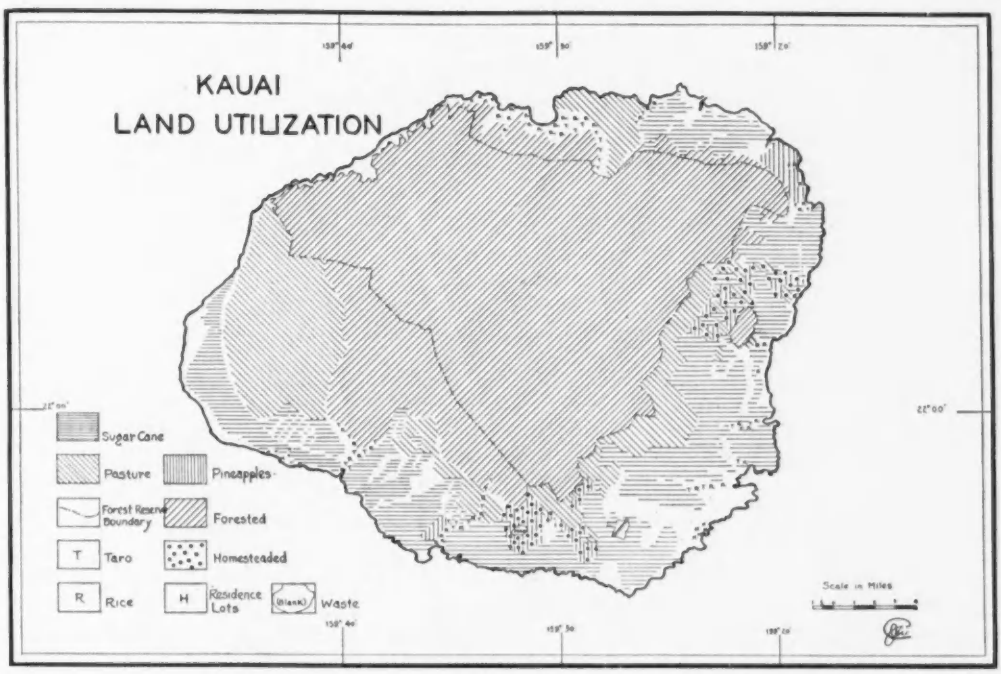

FIGURE 1.—Land utilization on the island of Kauai in 1930. The areas homesteaded are used for small farming.

The Kalaheo small farming district in southern Kauai consists of three adjoining areas, namely, Kalaheo, Lawai, and Omao. In the Kalaheo area there are 160 farms averaging 12½ acres per farm; those in the lower, younger section, however, are appreciably larger than those in the upper, older section of Kalaheo; in Lawai there are 69 farms with an average of 13½ acres, and in Omao, 49 averaging 6 acres. Nearly all the farms are owned in fee simple. Most of them are operated by the owners; the remainder are leased.

DESCRIPTION

The land of the small farming area is steeply rolling, dissected by gulches, and with a marked general gradient from the mountains to the coast. Scattered

clumps of trees stand out conspicuously—indigenous *hala* and *koa* and introduced ironwood, eucalyptus, and Norfolk Island Pine. Along the foothills lies a narrow belt of light green sugar cane fields, the borders of which are determined by the degree of slope and boundaries of farms; interspersed with the cane fields are small, irregular areas of pasture. Below them are scores of fields of pineapples, dark green, and also irregular in shape. In some the crop is ready for harvest; in others slips and tops are growing through paper mulch. Scattered patches—reddish brown—have been plowed recently. Throughout the pineapple lands stand large unused areas overgrown with weeds among which can be traced the rows of former beds of fruit. County roads, paved or gravelled, traverse the countryside in various directions. From them narrow, lateral roads or lanes run half-a-mile to a mile and terminate at farmsteads.

North of the Kalaheo small farming district on the lower slopes of the mountains lies a stretch of land used for pasture—at the time of the writer's December visit, greyish brown after a long dry season. Beyond it, the broken, rugged ridges of Kauai radiate from the old dome of Mount Waialeale of which there is now only a flat summit buried in clouds. South of Kalaheo along the coast lies the McBryde sugar cane plantation; beyond it, the vast stretch of the Pacific Ocean, the crested surf of which laps the shoreline.

The farmsteads of the upper and of the lower parts of the Kalaheo district differ appreciably in appearance, and the

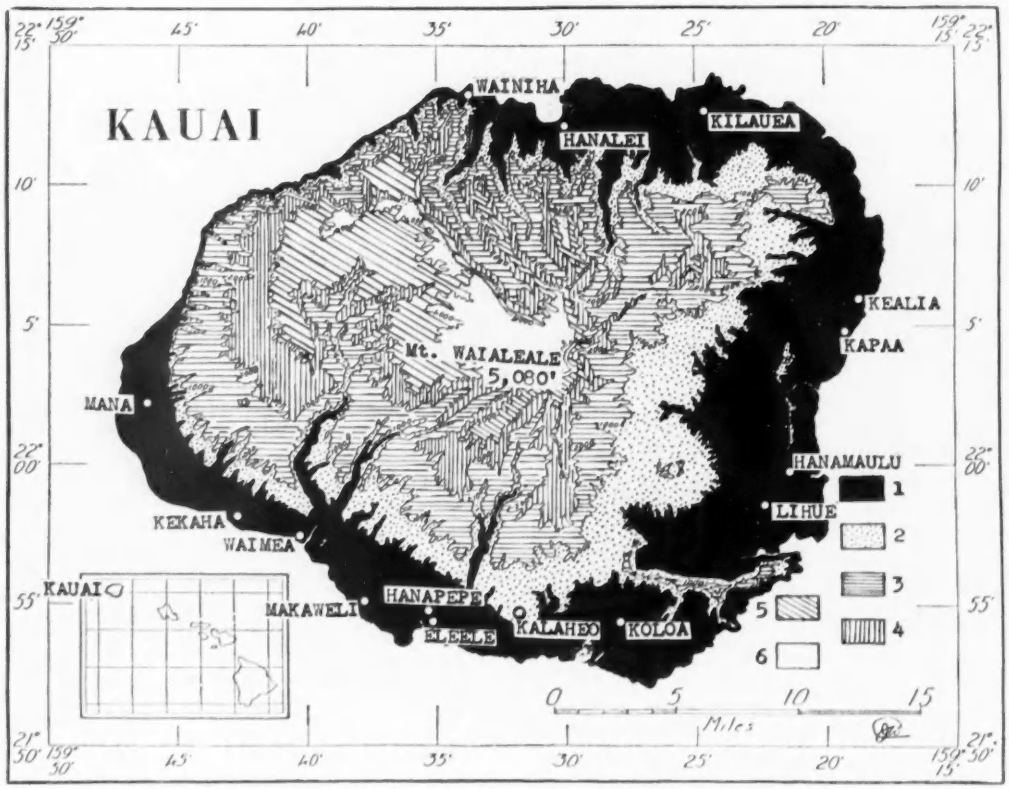

FIGURE 2.—Relief map of Kauai. 1. 0′–500′; 2. 500′–1000′; 3. 1000′–2000′; 4. 2000′–3000′; 5. 3000′–4000′, 6. over 4000′.

racial origin of the farmers is in marked contrast. On the higher land are neat, well-kept farmsteads with comfortable-looking homes and trim gardens. Houses are built of lumber with galvanized iron roofs. Though some of the structures seem old, they have been neatly repainted. Rural lanes, Bugin-villaea hedges, and beds of flowers with borders of ornamental canna suggest a countryside in southwestern Europe. On the road and in the gardens one sees Portuguese children at play—girls at hide-and-seek and boys romping with their dogs.

In lower Kalaheo the homes are smaller and many are unpainted; there are fewer gardens and larger farms. Aged Japanese men and women do chores about the farmsteads. In the late afternoon, groups of American-born children of Japanese parentage walk slowly towards their homes. If a visitor approaches the door of a home, a young American wife of Japanese parentage comes from within and greets him agreeably. On enquiry for her husband she answers—with a conscious attempt to speak English correctly—as to his whereabouts. If she does not know exactly, she turns to *papa-san* or *mama-san* and asks in Japanese and translates the reply to the visitor. Perhaps one gets a glimpse of *papa-san* and *mama-san* squatting on mats on the floor sorting potatoes or *daikon*, and near them a small grandchild playing with dolls or other toys.

HISTORY

To explain the racial distribution of farmers in Kalaheo it is necessary to recount some of the history of small farming there. The Kalaheo small farming district was made available for settlement by homesteaders at four different periods. The Kalaheo "first series" in 1906, Lawai in 1911, Omao in 1912, and Kalaheo "second series" in 1913. The Kalaheo first, upper series was homesteaded under a law which provided for an association of people to organize for the settlement of an area to be homesteaded. At that time the McBryde Plantation Company owned part of the *ahupuaa* (Hawaiian land division) of Kalaheo which was made available for small farms. The company exchanged with the Territorial Government at the rate of two acres of rolling upland for one acre of lowland near the coast. The latter which was

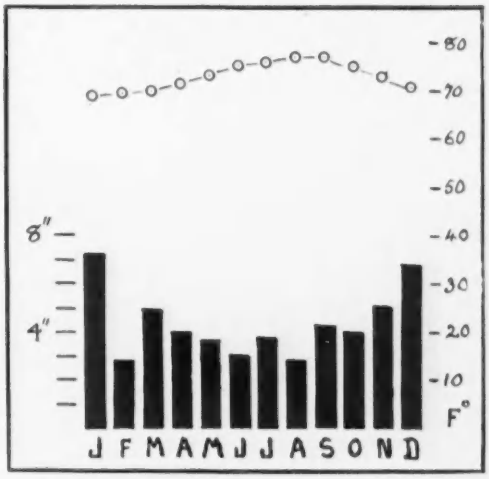

FIGURE 3.—Average monthly rainfall at Kalaheo and average monthly temperatures at Koloa. The average annual rainfall at Kalaheo is 52.33 inches. Temperature records for Kalaheo are not available. The elevation of Kalaheo is 631 feet, and that of Koloa 241 feet. The weather is similar in both places.

potentially irrigable seemed more valuable for sugar cane. As a rule the upland has more rainfall than the lowland, but in a dry season is hazardous for agriculture, especially for sugar cane because it is not irrigable. In 1906 the laborers on the plantation were largely Portuguese who chafed under plantation régime. It was understood that they, eligible for American citizenship, were to settle on the homesteads, acquire title in fee simple to their small farms, and at the same time continue to work

on the plantation. By that method of having many employees on small farms of their own, the company hoped to have a more contented labor force than it had then.

The other areas homesteaded, including the Kalaheo second series, were settled under a system of drawings by which individuals could receive patents to homesteaded land. In those years more Americans of Japanese ancestry were eligible to own land than at the time of the opening of the Kalaheo first series. In all, fourteen Americans of Japanese ancestry obtained homesteads of whom only four received them in the Kalaheo first series. Since the original homesteaders received patents, Americans of Japanese parentage have obtained titles by purchase, and Japanese citizens have leased farms from the owners. Homesteaders in the various areas also included Hawaiians and other American citizens of Spanish, Puerto Rican, Chinese, and Caucasian ancestries.

There are no statistics available regarding the numbers of people in the various racial groups in the Kalaheo district at present, but a recent enumeration of the pupils at the Kalaheo public school reflects closely the character of the population of the small farming area. In December, 1933, out of a total of 576 pupils, 311, or 54 per cent, were of Japanese ancestry, and 141, or 24 per cent, were of Portuguese origin. The distribution of nearly all of the remainder by racial ancestry is shown in the accompanying table.

TABLE I

RACIAL ORIGIN OF PUPILS IN KALAHEO SCHOOL

Ancestry	*Boys*	*Girls*	*Total*
Hawaiian	4	3	7
Part-Hawaiian	8	7	15
Portuguese	77	64	141
Puerto Rican	11	18	29
Spanish	5	9	14
Other Caucasian	3	3	6
Chinese	6	4	10
Japanese	185	126	311
Korean	4	..	4
Filipino	17	9	26
All Others	2	11	13
Totals	322	254	576

CROPS AND METHODS OF FARMING

The great majority of the farmers in Kalaheo raise sugar cane or pineapples as their money crop. Some engage in market gardening, some in mixed farming, and some in horticulture. As already stated, a great many of them do not depend entirely on their farms for a living. They earn money on their neighboring sugar cane plantation, in a large pineapple cannery at Lawai, working on the county roads,

FIGURE 4.—View of part of the Kalaheo small farming district.

driving trucks, and in various other ways. Some till their farms in the early mornings and late afternoons before and after work elsewhere. Others use full days at intervals between the times they engage in miscellaneous occupations. A considerable number of the young Americans of Japanese parentage devote nearly all of their time to their farms. Others, who have had their parents come to live with them, engage in agriculture only a small part of the time but the parents devote all of their time to operating the farms.

Farmers who use land for sugar cane buy seed and fertilizer from the McBryde Sugar Co. and raise a plant crop and two ratoons, doing the necessary hoeing and weeding themselves. Mules are commonly used for plowing and other phases of cultivation. A few farmers have tractors and when they have done their own work they, with their machinery, get employment on other farms by the hour or day.

There is no special season for planting sugar cane. The growing period for that crop in Kalaheo, as in most places in the Hawaiian Islands, is from 16 to 20 months; so the farmer obtains a return from his land only once in each year and a half to two years. The farmer cuts his own cane but depends on the agent for the plantation company to purchase it and to haul it to the mill. The price paid bears a fixed relationship to the selling price for raw sugar in New York.

Until 1921 the farmers in the upper small farming area, nearly all of Portuguese origin, raised sugar cane. The slump in market price for sugar in that year, the continuously low prices of subsequent years, and a contemporary boom in the pineapple industry in the Hawaiian Islands caused a considerable number to give up cane for pineapples. Those raising sugar cane at present do so in part because the work is less onerous than raising pineapples, in part because the market for pineapples has also fallen off, and also because they do not know to what else to turn. Some who have permanent jobs elsewhere have let most of the area of their small farms fall into disuse.

The Americans of portuguese descent are good farmers and, by their industry, have been able to keep their land. Less coöperative than the Orientals, they enjoy, however, advantages which result from the coöperation among the latter. Whatever agreement is made by the can-

FIGURE 5.—A Portuguese home in Kalaheo.

nery with the united Japanese, is extended to include the other racial group.

Farmers who raise pineapples depend for a market on a large company—the Kauai Fruit and Land Company—which has hundreds of acres of land planted to that fruit. The company furnishes fertilizer to the farmers on account, and, just before the harvesting season, advances cash to those who must pay for any extra labor necessary at that time.

The growing season for pineapples, also 16 to 20 months, entails a return on the outlay for the crop in a period similar to that for sugar cane. The cultivation of the land and care of the plants necessitate more onerous labor than for cane. Generally farmers raise only one ratoon, as the plant crop and

ratoon have not been given sufficient care to enable the parent root to produce profitably a third time.

The slump in the pineapple market and the consequent restriction of the area used for that crop by the large companies in the Hawaiian Islands has, of course, also been a disadvantage to the small farmers who raised that fruit. A third of the land on pineapple farms is unused. The Lawai cannery (Kauai Fruit and Land Company) has contracted to buy only 65 per cent of what the farmers have raised as winter crop this (1933–34) season. The rest must be disposed of as best they can.

The pineapple farmers, mostly Americans of Japanese parentage and Japanese, work hard, but a lack of capital handicaps them in carrying on. Many cannot afford to plant through a paper mulch, the customary way, but place the slips and crowns directly in the bare soil. Women help in the fields and children assist also during school vacations.

Industry and thrift characterize the young American farmers of Japanese ancestry and their parents who, excluded from naturalization by our laws, are still citizens of Japan. They live frugally, work hard and try to improve their education and ability. Through a selected leader they coöperate effectively with each other and with the executives of the cannery where they market their most important crop. Newcomers to the area buy or lease land from discouraged farmers who have given up—largely from those of Puerto Rican and Spanish ancestries.

The few farmers who use their land or part of it for market gardening are confronted with several problems. They are poorly informed about the raising and standardization of vegetables. The Japanese know little about varieties in demand in an Occidental market and generally raise those which they can sell to people of their own race. A well distributed and abundant rainfall and high temperatures throughout the year cause weeds to grow luxuriantly and rapidly, and they can be kept under control only by persistent labor. The problem of pests is a serious one as it requires specialized knowledge and methods of control. The absence of extreme cold gives the opportunity to insects to multiply throughout the year, whereas in temperate zone climates the cold of winter kills many, causes a large number to hibernate and inhibits during that time the reproduction of those that survive.

Among the vegetables raised in Kalaheo are Japanese radishes, Irish potatoes, sweet potatoes, corn, and tomatoes. Some market gardeners raise two or three crops a year. They have no regular market but peddle their products

FIGURE 6.—A pineapple field in the Kalaheo district. Japanese homes in the background.

about the small farming area and in the neighboring village of Hanapepe.

Mixed farming and horticulture in the area are scarcely worthy of mention. A number of Portuguese families keep a cow each to supply milk for their own use, and a few of them sell milk to neighbors. Some raise a few hogs and chickens. An enthusiastic and leading horticulturist is a young American of Japanese parentage recently graduated from a university on the mainland of the United States. He is trying to interest farmers in the raising of citrus and other fruits.

FIGURE 7.—Japanese children help their parents in the pineapple fields. Scene in Kalaheo, Kauai.

SOCIAL LIFE AND POLITICAL ACTIVITIES

In Kalaheo, as in other similar small farming areas, social life and institutions are but little developed. Such activities of the Americans of Portuguese parentage center largely about the Roman Catholic Church in Kalaheo village. The Holy Ghost Feast is a social occasion as well as one of the religious observances.

Young Americans of Japanese ancestry have difficulty in adjusting themselves to a social environment partly Oriental and partly Occidental. Educated in American schools, they speak English to each other, but must talk Japanese to their parents who have had no opportunity to learn the occidental language. The children like to follow American customs and institutions and, for example, celebrate Christmas. Their fathers and mothers, born and raised in Japan, wish rather to honor the "New Year." The two cultures generally compromise by celebrating both occasions.

Three educational institutions in the district, a public school, a Smith-Hughes vocational school, and a Japanese language school, all try to meet the needs of the young people of Kalaheo. At the public school, instruction is given as far as the eighth grade; at the vocational school instruction is given in carpentry, machine shop practice, electricity, and automobile mechanics, but not in vocational agriculture. The Japanese language school, held after public school hours, concerns itself with speaking, reading, and writing Japanese. Through it the children enjoy language contact with their parents longer than otherwise and thereby a social problem in the home is ameliorated.

The Japanese parents are Buddhists, but most of the children have no definite religious leaning. Places of worship have not been established, partly because of the indifference of the children and partly because the hard necessity of earning a living leaves the parents with little time for anything else.

Political life in the small farming district climaxes at the biennial county elections. On Kauai, Americans of Japanese parentage have the largest racial share of the electorate, and Americans of Portuguese ancestry are next in number. There are, however, no serious racial antipathies nor prejudices on that island nor on the others in the archipelago, and a candidate is supported on the basis of his record as a citizen and a belief in his integrity. A few Amer-

FIGURE 8.—American-born children of Japanese parentage on Kauai.

ican citizens of Japanese and of Portuguese ancestries are members of the Territorial House of Representatives. The problem of dual citizenship faces many young Americans of Oriental extraction. About the time this study was made, 13 dual-citizen Japanese on Kauai were expatriated from Japan and remained citizens solely of the United States.

KALAHEO VILLAGE

Kalaheo village is the most important business center for the small farmers. It is situated in the oldest part of the farming area at crossroads along the sides of which stand at intervals places of business which serve the farmers. A post office, general merchandise stores, gasoline and oil stations, and a bakery are the principal places of business activity. Religious, recreational and social centers include a Roman Catholic Church, a moving picture theater, and a community hall. At one end of the village, a group of buildings and adjoining yard comprise headquarters for the business of transporting the sugar cane of small farmers to the McBryde mill. On the opposite end, a more elaborate equipment forms field headquarters for the Kauai Fruit and Land Company which purchases the small farmers' pineapple crop. There are also in the village the three educational institutions mentioned.

FUTURE

It is as difficult to prognosticate the future of small farming in Kalaheo, as it is for that kind of agriculture in the Hawaiian Islands as a whole. As shown by the study, the farmers there in general raise sugar cane and pineapples, the two major crops of the islands—which are crops, however, that can be raised more profitably by plantation agriculture. Had many of the farmers no additional means of earning a living, they could scarcely carry on.

It is significant for small farmers that more than a million dollars worth of fresh vegetables are imported into the Hawaiian Islands annually from the mainland of the United States. They include Irish potatoes, sweet potatoes, tomatoes, peas, carrots, and cabbages. It has been shown by other studies that farmers in Hawaii could do more than they do at present to supply the local markets with those products. Those who raise sugar cane and pineapples might well raise some vegetables also. As suggested, however, there are a good many problems to be solved.

A part solution of the problem of educating young farmers in Kalaheo suggests itself in the establishment of a Smith-Hughes vocational agricultural school. Two such schools—the only two on Kauai—have been established at

FIGURE 9.—Japanese small farmers on Kauai pounding dough for *mochi* or rice cakes.

Eleele and Lihue, areas where plantation agriculture is carried on. The need for an agricultural school seems great in an area of small farming, especially where many young people are anxious to fit themselves for earning a living in a new economic and social environment.

Children of Portuguese ancestry have little difficulty in fitting into American life and institutions, but they must be taught farming. Boys and girls of Japanese parents need special help and guidance in other ways as well as in agriculture. They are hard working and like the soil—a preference inculcated through many generations. Toiling in a country in which they gained citizenship by accident of birth, they have had American ideas and ideals instilled in them. Through education agriculture can be made an outlet for their ambitions, hopes, and aspirations. The education of young people in general in farming is a phase of an economic and social problem on Kauai as on other islands in the Territory. The environment of Hawaii restricts human adjustments essentially to agriculture. In the best agricultural adjustments will the population enjoy the most economic prosperity.

An aspect of the future of small farming in Hawaii suggested by this study is one concerning which the writer has not as yet investigated sufficiently to form an opinion; that is, the use of small farms as a means of making plantation laborers more content with plantation régime than they appear to be at present. If plantation workers could have title in fee simple to small farms or long term leases on places where they had their homes and gardens, it is possible that they would be content with plantation life. That phase of the problem will be the subject of further study.

THE LOCALIZATION OF FUNCTIONS IN THE POMONA AREA, CALIFORNIA

Willis H. Miller

THE Pomona Area, an arbitrary district chosen as the subject for this paper, comprises about twenty square miles in the extreme eastern part of Los Angeles County. Boundaries were established to include all the city of Pomona (population 20,804) and reasonable samples of each major type of rural land utilization found in the surrounding country-side (Figure 1). Nearly 80 per cent of the Pomona Area is on the middle slope of the smooth, gently sloping piedmont alluvial plain bordering the San Gabriel Mountains, but rocky hills dominate the northwest and the southwest corners (Figure 2).

Analysis of the cultural landscape—the objective expression of functions—reveals three major districts and eighteen minor sections in the Pomona Area (Figure 3). Stores, factories,

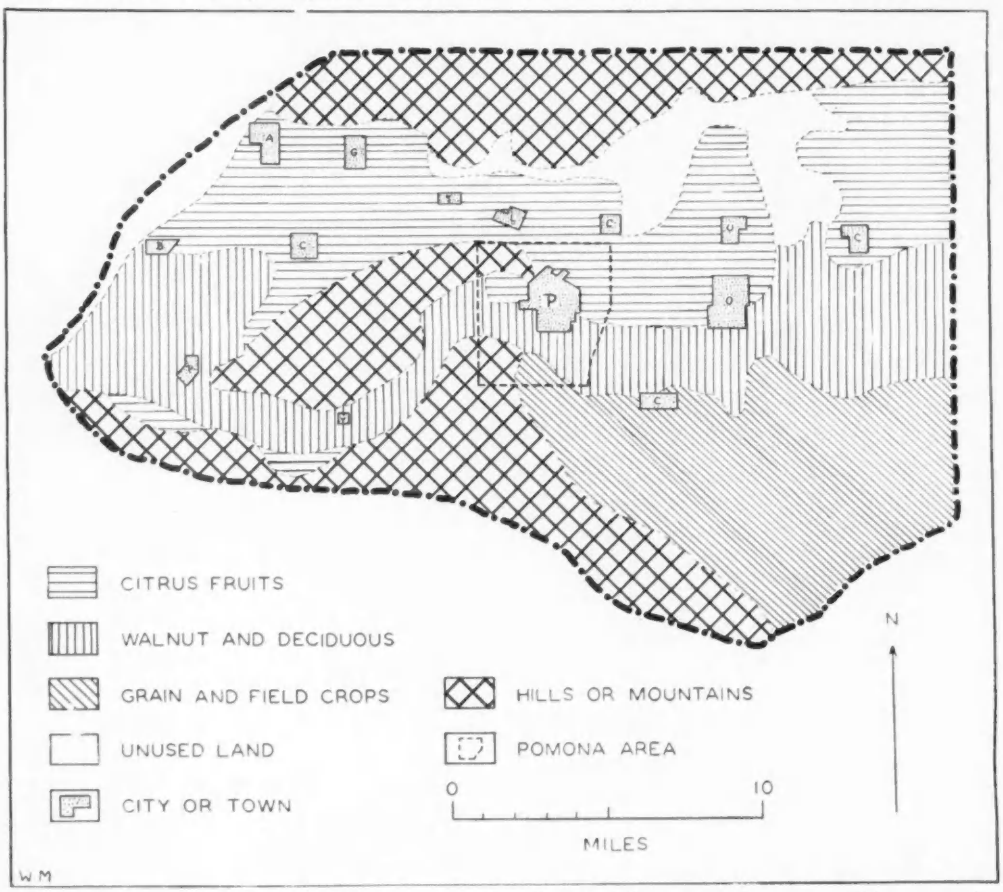

FIGURE 1.—Land utilization in the territory functionally tributary to Pomona. This reconnaissance map shows the zoning of crops, the grouping of cities in the prosperous Citrus Belt, the strategic location of Pomona at the eastern end of a wide pass between San Jose and the Puente Hills, and the variety of rural functions performed within the boundaries of the Pomona Area. Reference also should be made to the map on page 73 in Goode's *School Atlas* (revised edition).

FIGURE 2.—A winter view looking northeast over Pomona and vicinity. The city of Pomona is seen on the smooth, gently sloping alluvial plain at the foot of San Gabriel Mountains. Evergreen citrus groves stand out as dark areas, but deciduous walnut trees in the foreground are without leaves at this season. (Courtesy Spence, Los Angeles.)

churches, residences, and other city functional forms are localized within the Urban District where they are arranged in fairly symmetrical zones. The Peri-Urban District adjacent to the Urban District, is characterized by small, intensive poultry ranches and by large community establishments such as the Fair Grounds. Horticulture, agriculture, and besticulture predominate in the Extra-Urban District; citrus fruits, walnuts, and field crops occupy appropriate sections of the alluvial plain, while the rough, uncultivated San Jose and Puente Hills provide winter range for a band of sheep.

THE URBAN DISTRICT

Most of the common business, manufactural, commercial, institutional, and residential functions characteristic of a country city with 20,000 inhabitants, and in addition a variety of special commercial and manufactural functions reflecting the particular nature of the surrounding countryside, are found within the Urban District. These functions are localized within six distinct sections —the Business Section, the Railroad Section, the Northern and the Southern Institutional Sections, and the Northern and the Southern Residential Sections (Figure 3).

THE BUSINESS SECTION

Retail stores, cafés, hotels, offices, and other business establishments are concentrated in the Business Section near the middle of the Urban District and close to the center of population. The center of activity is at the junction of Second Street and Garey Avenue, the two most important highways of the Pomona Area (Figure 4). This Business Section has the greatest number of functions and the greatest congestion of functional forms in the entire Pomona Area. Localization is evidenced by (1) the type of establishment in the section, (2) the grouping of establishments, and (3) the functions performed at various levels (Figure 5).

Except for gasoline stations and food markets, both of which are common in outlying parts of the city, a majority of all retail stores located within the Urban District are found in the Business Section. These establishments primarily serve Pomona and Arena A, but they also supply residents of Arena B with most items not kept in stock by storekeepers in the small near-by towns (Figure 6). Few really superior quality stores are found in Pomona, however, because local people and residents of the surrounding countryside commonly go to Los Angeles to buy luxury and novelty goods.

Three subdivisions can be recognized within the Business Section—(1) a central core in the middle blocks of Second Street characterized by high-rent establishments (dry goods stores, drug stores, better restaurants, leading financial institutions), (2) an irregular zone about one block wide which surrounds the central core; this secondary zone has moderate-rent establishments (smaller financial institutions, food markets, household equipment stores), and (3) a patchy outer zone characterized by low-rent establishments (automotive concerns, old residences).

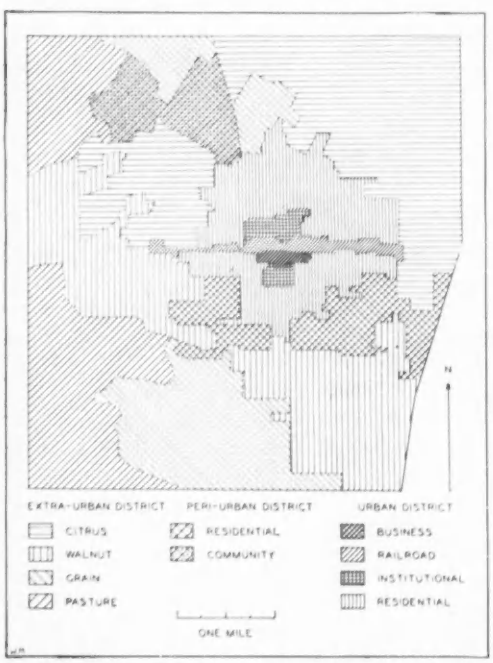

FIGURE 3.—The localization of functions in the Pomona Area as derived from field analysis of the cultural landscape. The Urban District occupies about 15%, the Peri-Urban District about 15%, and the Extra-Urban District about 70% of this territory.

Different functions are performed on the various floor levels in the Business Section. Retail stores occupy practically all street-level frontage and, in the middle blocks of Second Street, some space on the second-floor level. Stores function most successfully on the ground floor because such sites are conveniently accessible to shoppers, and because they are well placed to appeal to passers-by through the medium of window displays. Most second-floor space is devoted to offices, clubs, hotel rooms, apartments, and other functional forms which require close-in locations and moderate rentals. Offices and hotel rooms dominate the floors above the second story level. Reputation and service are the attractions of establishments of this latter type, and much of their business is done by appointment.

THE RAILROAD SECTION

The axial Railroad Section, a long narrow strip extending east and west across the center of the city, includes the tracks and depots of the Southern Pacific and the Union Pacific Railroads and practically all of the important commercial and manufactural plants in the Pomona Area (Figures 3 and 7). These plants are localized in the Railroad Section because it offers a combination of excellent railroad facilities, central location in the Urban District, and relatively low priced land.

The cultural landscape of the Railroad Section gives an impression of openness and low relief. In the central part, adjacent to the Business Section, the paral-

lel rights of way of the two railroads carry a total of seven tracks and serve to isolate the establishments on the north side from those on the south side. Separation of the half dozen major plants by small establishments and by vacant lots further contributes to the characteristic openness of this area. Sheet steel, lumber, and brick have been used to construct serviceable but ordinary looking industrial buildings. Some landscaping has been attempted in front of a few plants, but such aesthetic attempts only serve to emphasize the general unattractiveness of this part of Pomona.

The Railroad Section has the largest number of functions which are directly associated with Arenas B and C, and even more distant areas (Figure 6). These regional functions are performed by (1) manufacturing plants, (2) citrus handling establishments, (3) bulk goods handling establishments, (4) feed handling concerns, and (5) a variety of establishments including two laundries, two wholesale groceries, the gas and electric plants, a storage warehouse, contractors' yards, and several repair garages.

Except for the Pomona Tile Company which sells most of its product in Los Angeles, all of the manufacturing plants located in the Railroad Section are in Pomona to serve specific needs of the surrounding countryside. The Pomona Pump Company, largest industrial plant in the city, makes a water lubricated, deep-well turbine pump popular with ranchers and water companies of the neighborhood; practically all of the water used in this area must be pumped from the gravels of the piedmont plain. Markets in other parts of the United States and in foreign countries have increased so much that at the present time less than half of the output of this company is sold in California. The California Fruit Wrapping Mills

FIGURE 4.—Second Street looking west from Garey Avenue in the heart of the business section. Good examples of the old (right) and the new (left) styles of architecture are seen in the foreground. A striking predominance of awnings is observed on the sunny northern side of the street.

manufacture tissue fruit wraps which are distributed to orange packing houses throughout the Citrus Belt. The Brogdex Company produces machinery to apply a patented method of orange processing employed by scores of packing houses throughout Southern California. Eight small metal working plants manufacture and repair smudge pots, chicken ranch equipment, and other items used by the ranchers in the vicinity of Pomona.

Three citrus packing houses—the independent Baker Citrus Company, and two plants of the Pomona Fruit Growers Exchange—pack several hundred thousand boxes of citrus fruits produced each year by the groves which almost surround the northern half of the city.

Bulk goods are handled and distributed by eight wholesale oil depots and by seven lumber yards. Pomona oil depots formerly served Arena C, but in recent years similar distribution plants have been established in Ontario, Covina, and other towns which have grown rapidly in population during the past two decades. At present, therefore, petroleum products from the Pomona depots are distributed chiefly to points within Arena B. In the early days Pomona had the only lumber yard between Pasadena and San Bernardino. Newer yards in many other towns, how-

ever, have reduced the service area of local lumber yards to but little more than Arena A.

Six feed companies distribute feed to the poultry ranches within Arena A, and to a lesser extent to adjacent parts of Arena B. Most of this poultry feed is sold in the territory immediately south of the city where scores of small intensive poultry ranches are located. Similar feed concerns in other near-by towns make it impossible for the feed companies of Pomona to serve the more distant parts of Arena B. Los Angeles milling concerns grind and sack more than half of the feed sold in Pomona, but several local houses have electrically operated mills for grinding corn from Nebraska and wheat and barley from the San Joaquin Valley to suit the local trade. Grain raised in the neighborhood is not used by Pomona mills because it is poorer in quality than grain from more inland, fog-free areas.

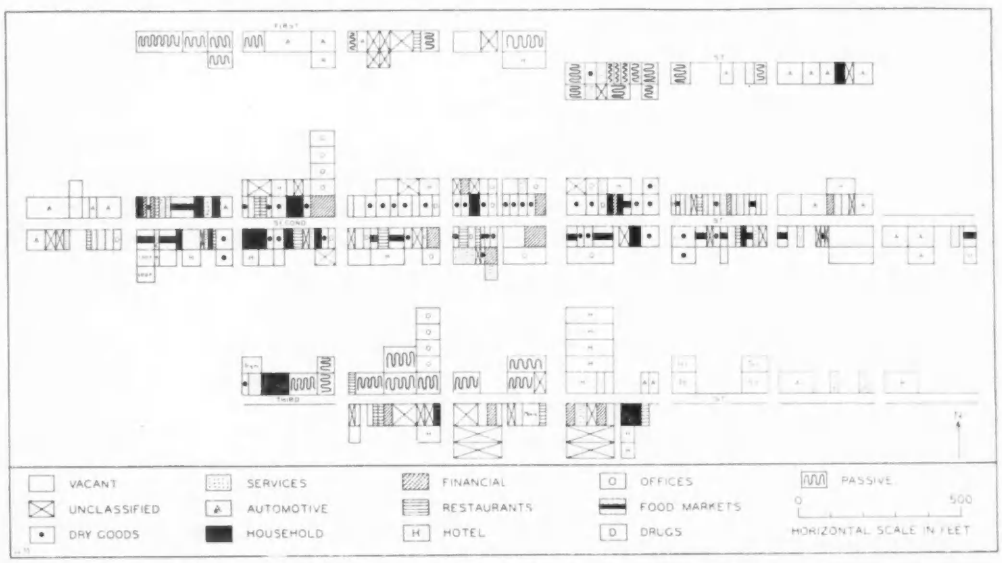

FIGURE 5.—Double profiles of the east-west business streets. This map graphically shows street-front utilization in the business section. The vertical scale is exaggerated about four times. Special attention is directed to the localization of dry goods stores in the middle blocks of Second Street.

THE INSTITUTIONAL SECTIONS

Institutional establishments—churches, government agencies, and clubs—dominate two close-in areas, one to the north and one to the south of the central parts of the Business and the Railroad Sections (Figure 3).

The Northern Institutional Section is located athwart the intersection of Garey and Holt Avenues adjacent to the populous and prosperous Northern Residential Section. Here are found ten of Pomona's twelve large churches, the headquarters of the Elks, the Knights of Pythias, the Y. M. C. A., the Boy Scouts, the Pomona Coöperative Exchange, the Municipal Employment Agency, the public library, and the Uptown Business Section (Figure 8). Blocks and parts of blocks between these establishments are occupied by big old dwellings which formerly housed some of the city's wealthy citizens. Within the past few decades virtually all of these houses have suffered a marked decline in quality.

The Southern Institutional Section is located just south of the Business Section at the intersection of Garey Avenue and Fifth Street. This section formerly had over 80 per cent of the insti-

tutional establishments of the city. Comparatively recent migration of functions to the North Side has left this southern section with but four churches, two clubs, the Salvation Army, the Pomona Valley Welfare League, the Chamber of Commerce, and the offices of the Los Angeles County Fair. However, all local and other governmental agencies functioning in Pomona, except the library and the employment office, still maintain headquarters in this older institutional section. The continuance of these governmental agencies in the Southern Institutional Section reflects the convenient proximity of this area to the Business Section and to the intersection of Garey Avenue and Second Street, highway focal point of the Pomona Area. Some of the oldest residences in the city are found between the institutional establishments which dominate this section. Most of these houses, like those of the Northern Institutional Section, have deteriorated greatly in recent years and now present a rather unkempt appearance.

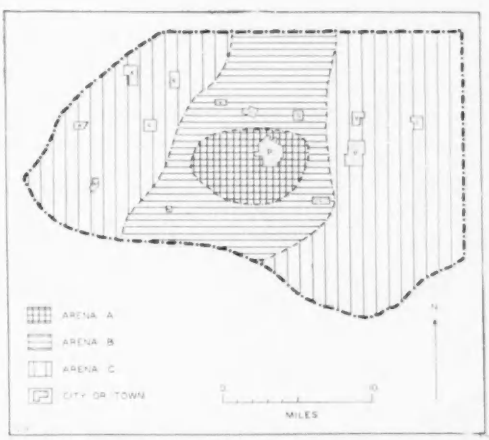

FIGURE 6.—Local territory functionally tributary to Pomona. Arena A is tributary to the city in practically every way. Arena B depends on Pomona for all the services and conveniences not provided by the small towns immediately surrounding the city. Arena C looks to Pomona for the district headquarters of numerous business and social organizations, and for the greatest variety of goods and services available in a single place between Pasadena and San Bernardino.

FIGURE 7.—Industrial plants in the central part of the railroad section. Three main line tracks of the Southern Pacific show in the foreground; the parallel Union Pacific right of way is slightly farther to the right.

THE RESIDENTIAL SECTIONS

Closely spaced residential establishments occupy the outer portions of the Urban District. Two distinct Residential sections can be recognized: (1) the newer, larger, more populous, and more prosperous Northern Residential Section which occupies a crescent-shaped area north of the Railroad and Northern Institutional Sections, and (2) the older, smaller, less populous, and less prosperous Southern Residential Section which occupies a squat T shaped area south of the Railroad and Southern Institutional Sections (Figure 3). The two Residential Sections show a localization of functions inasmuch as the one houses the high and upper-middle wage groups, while the other houses the lower-middle and low wage groups.

Residences in Pomona have been divided into four classes on the basis of quality—Superior, Better, Ordinary, and Inferior (Figure 9). Superior houses are large, attractively built and maintained residences set in large lots with a street frontage of 70 feet or more (Figure 10). Smooth velvety lawns and carefully tended shrubs and flower gardens surround Superior homes. In general spacing and in size the Better and the Ordinary type houses are similar; lots average little over 50 feet in width, and a majority of the buildings are five or six room bungalows (Figure 11). The Better homes, however, are

FIGURE 8.—The Congregational church and parish house. The establishment, located on the east side of Garey Avenue in the Northern Institutional Section, is one of the larger and finer of Pomona's many church edifices.

distinguished by their more substantial construction, their definitely good upkeep, and their neat lawns. Inferior residences in many cases occupy small lots, in most cases are of light construction, and in all cases are poorly kept up (Figure 12). Because of the cost of irrigation, lawns are either entirely lacking or are patchy and irregular in the yards which surround Inferior houses.

Over 80 per cent of the houses in both Residential Sections are bungalows. Better homes dominate the northern edge of the Northern Residential Section where they are built on land formerly devoted to citrus culture. Inferior houses, chiefly occupied by Mexicans, are found along the railroad tracks and in the southern part of the Southern Residential Section. Other parts of the two urban residential sections contain houses which range from 20 to 50 years in age. Some of these places were the homes of Pomona's leading citizens in the early days, but deterioration has now reduced practically all of them to Ordinary quality.

Other prominent functional forms found within the residential sections include several dozen neighborhood food markets and gasoline stations. Most of these establishments are scattered along the major boulevards. In the extreme northern part of the Northern Residential Section is located the modern, well equipped Pomona Valley Community Hospital which serves Pomona and Arena B. The site occupied by this hospital is especially favorable because it is in a quiet part of the city, close to Garey Avenue, and adjacent to the prosperous Better Residential divisions.

THE PERI-URBAN DISTRICT

Three extensive areas, two to the south and one to the north of the Urban District, are occupied by functions which are neither strictly urban nor strictly rural (Figure 3). Transition zones of this kind are common features of the landscape in many cities even though the precise type of land utilization within them may, and in many cases does, assume a variety of forms. Pomona's three Peri-Urban Sections are exceedingly dissimilar although each has a relatively open pattern as compared with that of the Urban District.

The two southern sections of the Peri-Urban District function as residential areas. These sections are characterized by garden homes and by half-acre intensive poultry ranches producing eggs for the Los Angeles market. Formerly this territory was devoted to orchards of peaches, apricots, plums, and other deciduous fruits. In about 1900 it became evident that such crops were no longer profitable due to competition from more productive peach and apricot plantings on cheap land in Northern California, and because winters in the Pomona Area are subject to unseasonable mild spells which may cause sap to run at an unfavorable time. Since the early years of this century, and especially during the last 15 years, orchards gradually have been replaced by the present functional forms.

The remaining peri-urban area, the

Peri-Urban Community Section, is located northwest of the Urban District on the eastern end or the San Jose Hills and an adjoining tract of rough stony lowland. Although such property has little utility as agricultural land, it provides admirable, close-in sites for such large scale community projects as the Fair Grounds, the Country Club, and a County Park as well as for an exclusive residential subdivision which capitalizes the rolling terrain and the superb view over the city, the Citrus Belt, and the San Gabriel Mountains (Figure 9).

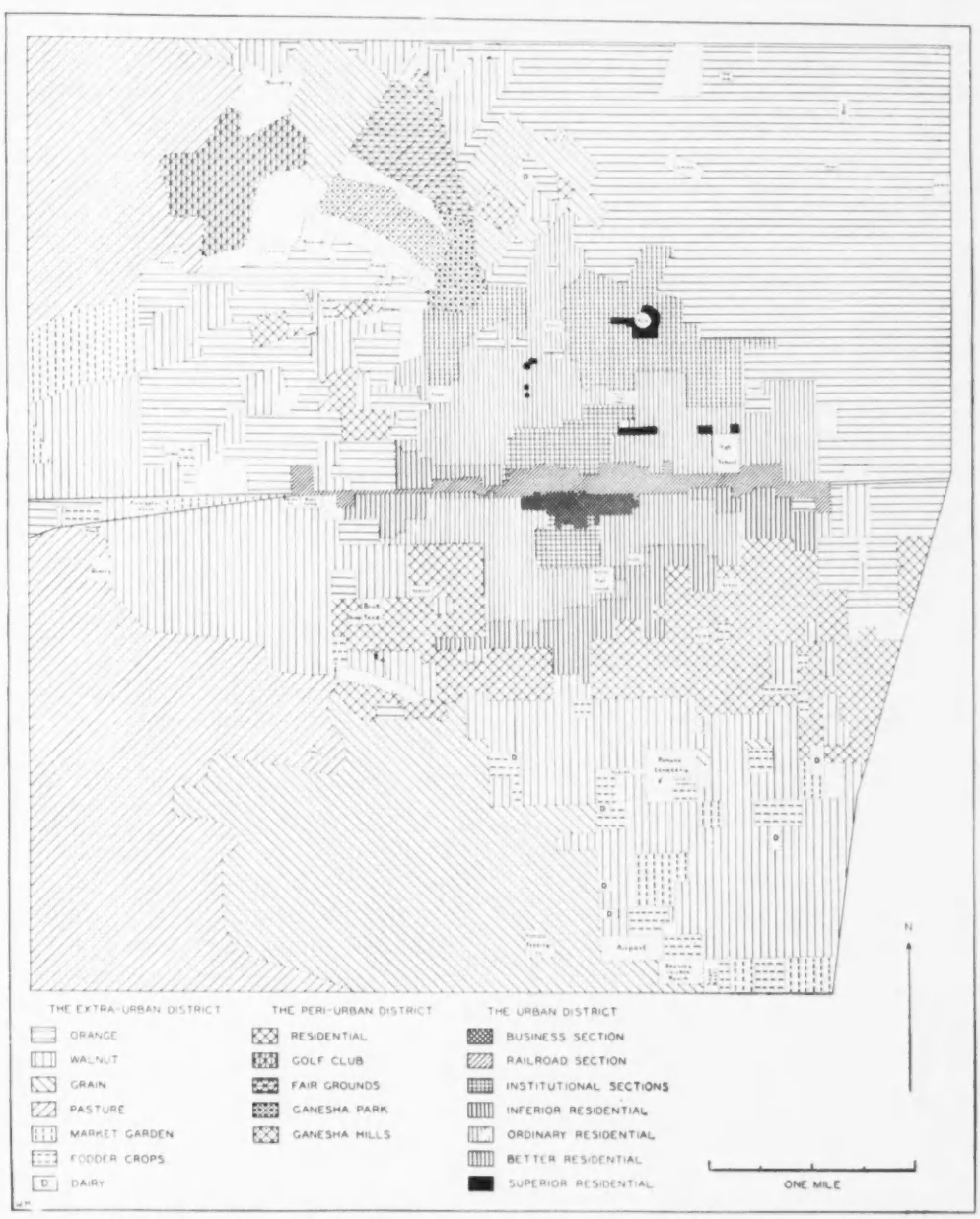

FIGURE 9.—Land utilization in the Pomona Area. In this map the residential sections of the Urban District are broken down into divisions, and each major special or exceptional feature of the Peri-Urban and the Extra-Urban Districts is indicated. Unused land is shown blank.

FIGURE 10.—Superior type home fronting Lincoln Park. Artistic mansions like this, kept in excellent repair, stand in sharp contrast to the bungalows and small frame houses which almost entirely dominate the residential sections of the Pomona Urban District.

THE EXTRA-URBAN DISTRICT

Citrus production, walnut production, grain growing, and grazing are the chief functions carried on in the rural territory tributary to Pomona (Figure 1). Each of these functions is distinctly localized. Citrus fruits are raised on the upper, relatively frost-free slope of the piedmont alluvial plain, walnuts dominate the middle slope where frost hazards discourage citrus growing but where deep alkali free soils are well suited to the deep-rooted walnut trees, and grain and other field crops are grown on the heavy soils of the lower piedmont plain. Rough hill country, entirely unsuited to cropping, is characterized by sheep and cattle pasturing.

THE CITRUS SECTIONS

Orange and lemon production within the Pomona Area is localized in two sections, one to the northeast of the city—a part of the Southern California Citrus Belt—and one west of the city—a small ectochore which has been isolated from the main Citrus Belt by recent expansion of urban forms in the Northern Residential Section (Figure 3). These Citrus Sections are well suited for citrus growing by reason of their light soils, gently sloping surfaces, ease of irrigation, and well developed air drainage. Over 90 per cent of the land within the Citrus Sections is devoted to profitable orange and lemon culture (Figure 9). In landscape and in functional practices the Citrus Sections are distinctive parts of the Extra-Urban District. Orange groves in this area average only about ten acres in size. Except for a small farmstead, each grove is occupied by rows of bushy, evergreen citrus trees planted 20 feet apart. Year around management is necessary to carry on the basic functional practices of fertilization, irrigation, cultivation, smudging, pest control, and harvesting.

Fertilization is an important functional practice in the Citrus Sections because the soils of the upper part of the piedmont alluvial plain are relatively poor in mineral salts and in humus (Figure 10). From 1,000 to 5,000 pounds of barnyard, commercial, and bean straw fertilizers are applied each year to every acre of citrus land. Cover crops, especially mustard, commonly are grown between the rows of trees during the rainy season. These crops are disked under in the late winter to add humus and valuable fertilizing agents to the soil.

Citrus fruits require about two acre feet of irrigation water during the dry season—from April to November. As in other parts of the Pomona Area water must be pumped from deep gravels of the piedmont plain, but the methods of obtaining and utilizing this water are functional practices localized within the Citrus Sections. Large scale growers own their wells and power pumps, but most of the numerous small growers belong to one of the several mutual water companies. All of these companies own extensive water rights and operate wells and pipe lines. Citrus trees have shallow roots so the groves are irrigated lightly at intervals of from three to four weeks.

Except during the winter season when

cover crops are growing, clean cultivation is practiced in the orange and lemon groves of the Citrus Sections. This process eliminates weeds, conserves water, and breaks the surface crust which forms on the soil after it has been wet.

Smudging is a functional practice which is entirely localized within the Citrus Sections. Although citrus groves are located on the upper comparatively frost-free slopes of the piedmont plain, freezing temperatures sometimes are experienced on clear, still winter nights. At such times orchard heaters (elaborate smudge pots) filled with cheap oil are ignited to stir up convection currents, to raise the temperature of the air near the trees, and to form a dense cloud of smoke thereby reducing radiation of ground heat.

The constant battle waged by citrus ranchers against insects and other pests is a strikingly characteristic feature of the Citrus Sections. Insects and other enemies seriously menace the health and even the lives of orange and lemon trees although the most dreaded pest, the Mediterranean Fruit Fly, apparently has been exterminated from the United States. Fumigation, spraying, and dusting are necessary to keep a grove in healthy condition. County agricultural agents inspect all groves at frequent intervals and enforce stringent legal regulations concerning pests.

Harvesting functions in the Citrus Sections are distinctive as to season and methods of performance. A great majority of the oranges grown in the Citrus Sections of the Pomona Area are navels which ripen in the winter. Gangs of experienced pickers, working by the day under the direction of the Exchange, use exceedingly careful methods in harvesting and handling this delicate fruit (Figure 13).

THE WALNUT SECTIONS

Groves of hardy Placentia or Eureka walnuts dominate two sections which almost surround the southern half of the Urban District and the Peri-Urban Residential Sections (Figure 3). The landscape here has a spotty aspect, however, for in addition to walnut groves there are a number of dairies, market gardens, and fields of fodder crops (Figure 9). Much of this territory formerly was occupied by deciduous fruit orchards. These orchards proved unprofitable and, during the last score of years, largely have been replaced by walnuts. Because of their large size and wide-spreading branches, walnut trees are planted from 40 to 60 feet apart in straight rows. This wide but regular spacing of trees, a feature characteristic of and localized within the Walnut Sections, contrasts sharply with the close spacing observed in the Citrus Sections. In general the functional practices of walnut culture are similar to those of citrus culture, but material differences are found in the seasons and in the methods of their performance.

Fertilization is a problem of only moderate importance in the Walnut sections for they are located on fairly heavy

FIGURE 11.—A typical bungalow of the ordinary type. Houses similar to this are characteristic of the ordinary divisions of the residential sections and are the most common dwelling not only in the Pomona Area but in Southern California.

FIGURE 12.—A small cottage of the inferior type. Many such homes in the inferior residential divisions are occupied by poor Mexican families. This dwelling shows every evidence of exceedingly light, cheap construction which, however, is serviceable in this mild, relatively dry climate. Potted plants on the porch and the aerial on the roof evidence the Mexican's desire for color and music.

soils of the middle slope of the piedmont plain. These soils are comparatively rich in humus and in mineral salts. Some walnut growers feel that the annual fall of leaves and tree litter is enough to maintain soil fertility, but others add small quantities of barnyard or commercial fertilizer. Winter cover crops commonly are raised in mature walnut groves for the same reasons and in the same way as in citrus groves.

Certain functional practices of irrigation are localized in the Walnut Sections. Because the water table is here relatively close to the surface (less than 100 feet) most walnut ranchers operate their own wells and pumps. Heavy irrigation is done about once in every six weeks to keep the deep-rooted walnut trees supplied with moisture.

Clean cultivation is characteristic of mature walnut groves, but a variety of inter-crops are raised in young groves while the trees are too small to shade much of the ground (Figure 14). By this method a grove can be made to pay its way before the walnut trees are large enough to bear in commercial quantities. Peaches are the most popular of these inter-crops, but vegetables and fodders are favored by many ranchers.

Pruning, carried on in the winter when the bare limbs are visible and accessible, is the chief feature in caring for walnut trees. From the point of view of pest control the Walnut Sections stand in sharp contrast to the Citrus Sections. Because of the recency of this walnut development no pests have been observed until the last few years. Now, however, a certain amount of spraying and dusting is necessary in many groves in order to combat walnut husk flies, San Jose scale, and codling moths.

Walnut harvesting is, perhaps, the most unique functional practice of the Walnut Sections. Most operations are carried on by itinerant Mexican families who camp in the grove and supply at low cost the necessary unskilled labor. The men wield long poles to shake down the ripe nuts; then the women and children gather them from the ground, pull off the husks, and put the bare nuts into sacks. Later the rancher dries the nuts either in the sun or in an oil burning dehydrator before he hauls them to a nearby Association packing house.

THE GRAIN SECTIONS

Grain fields formerly covered much of the Pomona Area, but the introduction of more profitable crops has driven grain production back to the heavy clay soils of the lower piedmont and the rolling parts of the Puente Hills (Figure 3). Two small Grain Sections also occupy parts of a tract north of the Urban District where the soil is too rough and stony for horticulture.

The forms and functions of grain growing are entirely different from those characteristic of the other parts of the Extra-Urban District. Trees, roads, and houses—all common in the Citrus and the Walnut Sections—are exceptional features of the Grain Sec-

tions (Figure 15). Wheat and barley are grown by extensive, dry farming methods. Fields are seeded in January, after the rains have moistened the soil, and are harvested in late May by travelling threshing crews. Little attention is paid to the crop between planting and harvesting except to harrow the fields once or twice to hinder weed growth and to form a protective dust mulch.

THE PASTURE SECTIONS

The pasture sections occupy rough, infertile, unirrigable land in the higher and more remote parts of the San Jose and the Puente Hills (Figure 3). With only two small tracts, a quarry and the sewage disposal plant, devoted to functions other than grazing, these Sections provide the largest and most perfect examples of localization of functions in the Pomona Area (Figure 9). As the only non-agricultural part of the Extra-Urban District the Pasture Sections are unlike the Citrus, the Walnut, and the Grain Sections in every way except climate and situation.

Even the landscape expressions of this grazing activity—sheep, pens, and a bunk wagon—are distinctive of and localized within the Pasture Sections (Figure 16). A herder and his dogs run 2,000 head of sheep on this hill pasture during winter months when rains revive the native grass and shrubs. In the dry summer time these sheep are driven to the lower piedmont plain near Chino to feed on the sugar beet tops, tomato vines, and grain stubble then cheaply available in that area.

CONCLUSIONS

This study of the Pomona Area, with special reference to the localization of functions, warrants conclusions concerning (1) the relation of Pomona to Metropolitan Los Angeles, (2) the area tributary to Pomona, and (3) the probable trends of functional development.

RELATION OF POMONA TO METROPOLITAN LOS ANGELES

The Bureau of the Census included Pomona within the boundaries of Metropolitan Los Angeles when, in 1930, it added to Los Angeles "all adjacent and contiguous civil divisions having a density of not less than 150 inhabitants per square mile." Such procedure may or may not be justified in the case of other cities, but this study of Pomona offers a mass of evidence showing conclusively that Pomona is definitely a country city, and not a part of Metropolitan Los Angeles.

Two natural factors (1) distance, and (2) the presence of marked topographic barriers—the San Jose and the Puente Hills—serve to isolate Pomona from Los Angeles and to give Pomona a market degree of local importance. The number and variety of retail stores, for example, indicate that Pomona has the character of a trading center rather than that of a suburb. Nine major oil companies maintain wholesale depots in Pomona to serve the city and the surrounding countryside; if Pomona were a suburb petroleum products probably would be distributed from Los Angeles.

FIGURE 13.—Picking navel oranges in February. Attention also is directed to the close spacing of the bushy orange trees and to the unmistakable evidences of clean cultivation.

The Pomona Valley Community Hospital, the presence of wholesale groceries, a large bakery, and a strong daily paper are other powerful evidences of independence from Los Angeles. It must be understood, however, that Pomona, like the other cities of Southern California, is tributary to Los Angeles in banking, wholesaling, luxury retailing, and those other "big city" functions which give Los Angeles its unusually developed capital quality.

TERRITORY TRIBUTARY TO POMONA

As one of the major country cities of Southern California, Pomona is the market and service center for an important local territory. Three subdivisions—Arenas A, B, and C—are recognized in this territory. In addition to these three local service areas Pomona has definite relations with other parts of California, with most of the United States, and with several foreign countries. Pomona has a measure of importance in Southern California for (1) the activities of the California Fruit Wrapping Mills and the Brogdex Company tie Pomona to the citrus producing areas, (2) the Southern Service Company with headquarters in Pomona operates a chain of laundries in Southern California, and (3) the Los Angeles County Fair now is a tri-county organization representing Los Angeles, Orange, and Riverside Counties. Pomona-made canned fruits, pumps, and tile are favorably known throughout much of the United States. Pomona navel oranges are sold in those numerous and widely distributed parts of the commercial world which buy California citrus fruits. Reasonable quantities of Pomona-produced pumps and fruit wraps also enter into world trade.

Pomona's contacts with Arenas A, B, and C are vastly more numerous and frequent than are its contacts with more remote areas. However, even Arena C is tied to Pomona only by a relatively small number of functions. Arena B, by contrast, looks to Pomona for most of that wide variety of goods and services characteristic of a city of 20,000 population, but not commonly found in towns of 2,000 or 3,000 inhabitants. Arena B, therefore, is the maximum territory which logically can be considered to be Pomona's tributary area.

FIGURE 14.—Cultivating walnuts in March. The wide spacing and large size of walnut trees facilitate the use of modern farm machinery. Clods in the newly upturned earth in the foreground indicate the comparatively heavy character of this soil.

PROBABLE TRENDS OF FUNCTIONAL DEVELOPMENT

Certain trends of functional development under way for some time can be recognized which, *certeris paribus*, may

be significant in the future of the Pomona Area. Each of the three major districts illustrates such trends.

The Urban District.—The growth of population in Pomona's Urban District probably will continue to be steady and somewhat slow. Since 1874 Pomona has shared in the steady population increase enjoyed by most cities of Southern California. This condition should maintain, for Pomona has a central and fairly average position in the valley of Southern California, and is well placed to participate in the expansion of many functions already established in this region as well as in the development of new functions. The anticipated slowness of this increase in population can be accounted for by the facts that much of the territory tributary to this city is almost unproductive hill country, that the more disirable parts of the tributary area are now quite intensively developed, and that the near-by smaller towns are increasing in size and reducing the number and frequency of the contacts which Pomona has with its tributary area.

With the coming of added population to Pomona a vital question will arise. Where will this population localize? The city seems sufficiently mature to warrant the assumption that there will be a continuance of the trends now operating. The more prosperous newcomers will demand houses on the North Side—especially along the northeastern border of the present Northern Residential Section. Poorer people probably will live south of the tracks where their homes will help fill out the normal crescent shape of the T shaped Southern Residential Section.

Unless rebuilding and modernization of residences progresses at a much accelerated rate, many old houses in the present Ordinary Residential Divisions can be expected to deteriorate till they are of Inferior quality. In this event the Ordinary Residential Divisions will decrease in size, and the Inferior Residential Divisions will increase accordingly.

FIGURE 15.—A general view in the southwestern grain section near the southern border of the Pomona Area. The dark fields on the left are planted to grain. Trees in the background mark the beginning of walnut groves farther up the sloping piedmont plain.

The Business Section probably will maintain itself as the chief retail district of the city. The intersection of Second Street and Garey Avenue, a major highway focal point of the Pomona Area, should continue to mark the heart of the shopping center. Further expansion of the Business Section can be expected to take place southward because this territory is closer to the heart of the shopping center than are the outer ends of Second Street; extension northward is blocked by the railroads. Continued development of the Uptown Business Center can be anticipated concomitantly with

the growth of the populous and prosperous Northern Residential Section.

Because of its superior transportation facilities, because of the relatively low cost of sites, and because of a newly adopted municipal zoning ordinance, commercial and manufactural plants will continue to localize in the Railroad Section. It is almost certain, however, that any new relatively large concerns will locate in the outer thirds of this section where large blocks of land are still available at reasonable cost.

New institutional functions may well locate in the present Institutional Sections. The same qualities which have attracted present-day institutional functions to these areas still maintain. Both the Northern and the Southern Institutional Sections are located near the center of the Urban District, close to the residential areas, and in reasonable proximity to the intersection of Second Street and Garey Avenue. In each of these sections, moreover, numerous sites now occupied by deteriorating houses are obtainable. Since the North Side definitely has emerged as the better residential area, new churches and clubs can be expected to locate in the Northern Institutional Section, but the Southern Institutional Section, partly because of its nearness to the Business Section, has become intrenched as the seat of governmental agencies.

The Peri-Urban District.—If and when the Southern Residential Section assumes a normal crescent shape, practically all of the southern Peri-Urban Residential Sections will be absorbed. This indicates that the forces of sequent occupancy are still of potential importance. Even relative stability can not be expected until this territory has been urbanized. The Peri-Urban Residential Sections, therefore, seem to be temporary features of the Pomona Area although they may be recognizable for many years if the population of the city grows more slowly than is anticipated.

FIGURE 16.—Sheepherder's cook and bunk wagon. This focal point of pasture activities is located near the sheep watering troughs in the Puente Hills, southwest of Pomona.

The Peri-Urban Community Section is ideally suited to the land it occupies and should be a permanent and perhaps an expanding feature of the Pomona Area. Mountain Meadows Country Club occupies a rolling basin in the San Jose Hills close to but outside of the municipal boundary where taxes are relatively low. The club is reached conveniently from the better residential sections of the city, and this combination of low taxes and convenience will work against migration of this institution. Ganesha Hills subdivision is between the Country Club and Ganesha Park just inside the city limits. Here homes can command water, fire protection, and other city facilities, as well as a magnificent view of the Citrus Belt and the San Gabriel Mountains. Ganesha Park occupies the abrupt eastern end of the San Jose Hills adjacent to the Urban District it is designed to serve. The Fair Grounds are on an area of level but infertile land close to the city and conveniently accessible from either Valley or Foothill Boulevards. Large size and high cost of installation will be powerful factors in maintaining all these functional forms in the Peri-Urban Community Section.

The Extra-Urban District.—Conditions in the Extra-Urban District can be expected to remain essentially as they

are; further expansion of the Northern Residential Section, however, almost surely will displace more orange groves. It also is probable that walnuts will invade some of the fields now devoted to fodder crops in the Walnut Sections, and some of the lighter soils in the eastern part of the Southwestern Grain Section.

The Pomona Area.—In general the Pomona Area seems to have entered the mature stage of its evolution. Developments will continue, but, except in the Peri-Urban Residential Sections, these developments should not result in pronounced changes. The Urban District is settled in its pattern, and citrus and walnut growing seem to be the climax functions of the extensive parts of the Extra-Urban District which they occupy. In short, the Pomona Area has assumed its rôle in Southern California and today appears as a comparatively stable, recognizable entity.

THE IRON ORE RESOURCES OF CHINA*

W. Belden and M. Salter

THE iron ore resources of China are much more limited than is generally supposed. Figure 1, showing the distribution of reserves, is based on the best available estimates, while Figure 2 has been constructed from the latest government and commercial publications. The importance of the reserves and production of Manchukuo compared with those of China can be seen clearly. The output of the Anshan area which possesses more than one-half of the known reserves of the country amounts to approximately two-thirds that of the rest of China (Table II). At present Japan controls 90% of the available Chinese and Manchukuoan reserves.

FIGURE 1.—The principal places of consequence in the iron ore distribution of China are designated upon this map. The western half of the country has no known deposits of importance.

Iron ore is widely distributed, although the reserves are not so abundant as those of coal, and commercial production is limited to three major fields: Southern Manchukuo, the Peiping District, and the Lower Yangtze Valley. Of these, the first mentioned is by far the most significant at the present time. In Outer Mongolia, Kansu, Sinkiang, and Szechuan, small and supposedly rich ore bodies are reported, but, since accurate information concerning them is lacking, they have not been plotted.

The total iron ore reserves of China are estimated to be only 1,000,000,000 tons of which 750,000,000 tons, or 75%, are in Southern Manchukuo (Liaoning) (Figure 1). Less than 25% of the reserves are high grade, in some cases the metallic content being as much as 60%. This is found in small scattered deposits, principally in Southern Manchukuo, Hopei, Hupeh, and Anhwei. A compilation of the various estimates of Chinese iron resources which have been made by various authorities in recent years is given in Table I.

The greater part of the reserves of Manchukuo are Archean, probably of sedimentary origin, bedded in crystalline schists, and interrupted by frequent granitic intrusions and faulting. The ore occurs in a relatively narrow field extending across the Liaotung Peninsula between the Yalu River and the Hun-Ho, a tributary of the Liao-Ho. "Localized pockets of high-grade limonites and hematites occur, interbedded with inferior grades." The greater part, however, consists of low-grade ore approximating 30% iron, and expensive

* Prepared under the direction of John B. Appleton, Dept. of Geography, Scripps College, California.

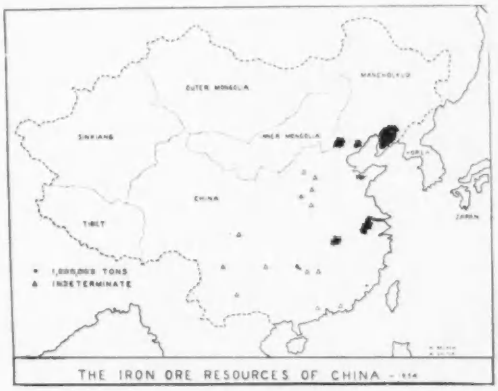

FIGURE 2.—The distribution of the various deposits and their relative importance is indicated by this map. With present transportation the resources of western China are negligible. (Based on Commercial Gazetteer of China, and researches of Bain, Humbert, Smith, and Wong.)

concentration processes are a prerequisite to their utilization in modern blast furnaces. In the eastern section of Liaoning, though consistently three feet thick, the ore bodies are discontinuous, making it difficult to estimate reserves accurately, and attempts to work them have proved unprofitable although the ores have an iron content of 50%. Further west, the beds are much thicker and more suited to exploitation. "The ore bodies, which average 30% iron, reach a maximum thickness of 300 to 600 feet at Miaoer-Kou, where two rich veins of 60% ore over 50 feet thick are being worked by open-pit methods." The Japanese are developing them extensively in order to provide pig iron for export to Japan, since it is not economical to ship the crude ore. The mines at Anshan, Kungchangling, and Miao-er-Kou, which supply the entire Manchukuoan production, are readily accessible to the South Manchuria Railroad system and to the coal fields of Penhsihu and Fushun, and form the basis for the Japanese-controlled iron and steel industry.

The greater part of the ore reserves of China proper are found in the north, those of Huan-Lung and the Yangtze Valley being the most important. Pre-Cambrian hematite ores occur in well-defined beds between slates and quartzites, in the Huan-Lung area of northwestern Hopei. Reserves are estimated at 90 million tons and their metallic content runs as high as 55%. They contain no phosphorous, only a small percentage of sulphur, some silica, and no other impurities. In North Shensi and South Shansi low-grade hematite deposits occur in thin beds generally less than three feet thick, making them unsuitable for large-scale mining methods. The ore is found in nodule form rather than in beds of uniform thickness. At present a number of small native enterprises mine it by open-pit methods to supply local needs.

Magnetite-hematite ores occur in close association with igneous intrusions of grano-dioritic rocks throughout eastern and central China. The deposits "are extremely irregular and continuity in any direction cannot be assumed in advance of actual exposure." They range from very small deposits to fairly large bodies of ore containing millions of tons. The only workable ores of this type are found in the Shantung Peninsula near Chinglingchen, where contact deposits are located near the Poshan coalfields

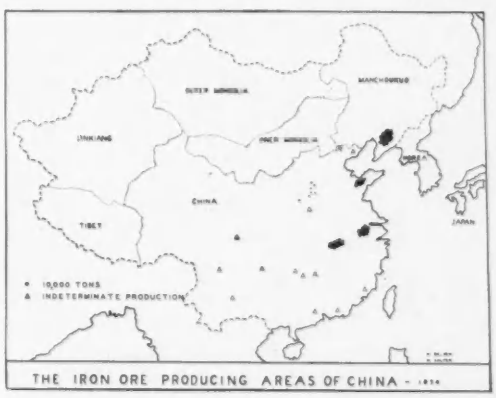

FIGURE 3.—The present utilization of the iron ores of China correspond fairly closely with the ore deposits of significance. (Based on China Year Book, 1933; Far Eastern Review, and published reports by Hseih and Torgasheff.)

TABLE 1

THE IRON ORE RESERVES

Province	*Location*	*Reserves*	*Authority*
Anhwei	Tangtu (Taiping, N.)	4,300,000	Bain
	(Taiping, S.)	4,825,000	Bain
	Taochung	60,000,000	Wong
	Tung Kuan Shan	2,500,000	Bain
Kiangsu	Feng Huan Shan	4,300,000	Bain
	Cheng Men Shan	6,300,000	Bain
	Tung Ling Shan	580,000	Bain
Hupeh	Tayeh	35,000,000	Humbert
	Hsiangpishan	15,100,000	Bain
Shansi	Yu Hsien	indeterminate	
	Pingting	"	
	Wuan	"	
	Chingcheng	"	
Shantung	Ching Ling Chen	13,700,000	Bain
Hopei	Hsuan Lung	96,645,000	Bain
	Luan Hsien	82,000,000	Bain
	Chi Kuan Shan	700,000	Bain
Liaoning	Anshan	200,000,000	So. Manch. R. R.
	Miao-er-Kou	100,000,000	So. Manch. R. R.
	Kung Chang Ling	300,000,000	So. Manch. R. R.
Fukien	Anki	2,000,000	Bain
Yunnan	Tunghai	indeterminate	
Szechwan	Kaihsien	"	
	Haupien	"	
Honan	Northwest area	"	
	Hungshan	740,000	Bain
Hunan	Paoking		
	Vengmotong	1,000,000	Wong
	Shantangtsun	5,000,000	Wong
	Yungchow	500,000	Wong
	Leiyang	indeterminate	
Kwantung	Shiuking	"	
	Waichowfu	"	
Kweichow	Northwest area	"	
Kiangsi		18,260,000	Wang
Chekiang		2,300,000	Wang
	Total	955,650,000	
	Workable	396,000,000	Smith
	Potential	555,000,000	Smith

and the Shantung Railroad. The ores, self-fluxing and non-phosphoric, are similar to those of Sweden and the Lake Superior Region and occur in fairly thick masses having a metallic content of 65% which ranks them among the best in the world. Though of high quality, the supply is very limited.

The reserves of greatest economic value, excluding those of Manchukuo, are found in the belt along the Lower Yangtze between Tayeh and Nanking, where at least five bodies of sufficient size to make mining practicable are known. These magnetite-hematite ores, containing from 40% to 60% iron with only a small percentage of sulphur and phosphorus, are readily accessible to the Ping Hsiang coalfields where coke suitable for metallurgical purposes is produced. The richest deposits occur on the western margin of the region, in Hupeh, where the Tayeh ores are found as a seam 200 feet wide. Open-pit mining methods are employed and a standard gauge railway provides connec-

TABLE II

THE IRON ORE PRODUCING AREAS

Province	*Location*	*Production*	*Authority*
Anhwei	Paohsing	135,000	C. Y. B. '33
	Tangtu (Taiping)	55,840	Hsueh
	Taochung	265,000	C. Y. B. '33
	Tung Kuan Shan	50,000	C. Y. B. '33
Kiangsu	Feng Huan Shan	50,000 (native)	Com. Gazetteer of China
Hupeh	Tayeh	425,000	C. Y. B. '33
	Hsiangpishan	83,000	C. Y. B. '33
Shansi	Yu Hsien, Pingting, Wuan, Chingcheng	70,000 (native)	Torgasheff
Hopei	Hsuan Lung	50,000	F. E. Rev. 6/34
	Luan Hsien	indeterminate	
	Chi Kuan Shan	"	
Liaoning	Anshan	817,000	C. Y. B. '33
	Miao-er-Kou	147,000	C. Y. B. '33
	Kung Cheng Ling	25,000	
Fukien	Anki	indeterminate (native)	
Yunnan	Tunghai	"	"
Szechwan	Kaihsien	"	"
	Haupein	"	"
Honan	Northwest area	"	"
	Hungshan	"	"
Hunan	Paoking		
	Vengmotong	"	"
	Shantangtsun	"	"
	Yungchow	"	"
	Leiyang	"	"
Kwantung	Shiuking	"	"
Kweichow	Northwest area	"	"
Kiangsi		"	"
Chekiang		"	"
	Total	2,172,840	

tion between the mines and the Yangtze. The cost of delivery to the river bank at Shi-Yuai-Yua is $1.50 (Mex.) per ton and to the steel works at Hanyang, $4.00 (Mex.) per ton, a little less than 100 miles distant.

Numerous deposits are found in widely scattered areas throughout southern and western China, but, in most cases, the iron content is low, the reserves are small, and conditions are unfavorable to mining operations except for purely local uses. The largest of these, at Anki (Fukien), contains reserves estimated at approximately 7,500,000 tons.

Chinese iron mines are usually small, seldom employing more than 100 men, frequently as few as 20. In the more up-to-date mines, particularly those under Japanese control, modern methods increase the average labor efficiency to 90 metric tons per man per year. As an illustration of this, in 1925, the Tayeh iron mines produced 241,785 metric tons, with a labor force of 2,500 men, a production of 81 tons per man. In contrast, the output in the United States averages about 2,400 tons per man per year. The total average number engaged in iron mining in China was estimated by Torgasheff, in 1930, to be between 43,000 and 100,000.

Despite these very limited reserves,

the Chinese Government at Nanking has conceived a ten-year plan for a more effective development of China's iron and steel industry by the construction of 100 modern blast furnaces of 300 tons capacity. Operations would be concentrated along the Lower Yangtze and a production of 12,000,000 tons of iron and steel per annum would thus be made possible. This market expansion would call for a great increase in the production of ore, a production far in excess of China's capacity to supply, and would necessitate a very large importation. Negotiations have been made with the Kondorfer interests of Germany for the financing of the first unit, for which the raw materials would be drawn from nearby iron mines of Tangtu (Anhwei) and Tayeh (Hupeh) and from the coalfields of Lishan and Lucheakou (Anhwei).

The realization of this plan or of any similar scheme is doubtful under present conditions. Inadequate transportation facilities, high production costs due to the character and location of the ore bodies, financial and personnel limitations, lack of political stability, opposition to foreign exploitation, and, above all, the limited resources of iron ore are likely to prove severe obstacles. The developments by the Japanese at Anshan and Penhsihu have, from the beginning, been a governmental enterprise rather than a commercial project and it is extremely doubtful whether or not the results justify the expenditure involved.

BOOK REVIEWS

VAN VALKENBURG, SAMUEL, AND HUNTINGTON, ELLSWORTH. *Europe*. x and 651 pp. Published by John Wiley and Sons. Price, $4.50.

No field of college geography has been more adequately covered in recent years than that of Europe. We are now provided with a number of texts, all having their excellence. And yet *Europe* by Samuel van Valkenburg and Ellsworth Huntington is welcomed for its originality and its novel method of approach. Both authors are known as men of inspiration and both have that quality which puts their writing beyond the usual academic style. Mr. van Valkenburg speaks authoritatively from an intimate personal knowledge of much of Europe. Mr. Huntington contributes editorial supervision which creates an essentially European manuscript into a most usable American text. Certain chapters are obviously Mr. Huntington's and yet he has restrained himself. Too often he has in other volumes presented ideas so original as to be difficult to use in the American academic scheme of things.

The book attempts to explain the "relation between geographical environment and the three great phases of Europe's development—economic, cultural and political." It succeeds certainly in the two first cases. One regrets that certain political problems are not more completely dealt with. Its philosophy is inclusive of the whole field of geography and is not limited to the now popular American conception that geography is no more than man's influence upon the natural landscape. One third of the book is given to the study of Europe as a whole, in distinction to the study of the separate countries. This is an interesting departure and the introductory portion is a distinct intellectual contribution. But the book as a whole is a piece of art and one arrives at the conclusion stimulated at finding a text which leaves the reader with a sense of the quality of European life.

Pedagogically the book is a great advance over many texts. It contains no pictures but has some 140 maps and charts. It is a veritable atlas. More than this, such constant references are made to the maps that they are an integral part of the text. The device of using large and small print has been resorted to so that the book may be adapted to a long or a short course. The small print is concerned largely with geological and historical matter. The historical matter is interesting but so incomplete as to have no great value. From the student's point of view it is to be questioned whether the long introduction is entirely a happy idea. Students group facts—in geography by countries. It takes a certain knowledge of Europe to follow through the introduction. After all though Europe is an entity, it is also an agglomeration of individual states. The only unfortunate part of the book is the dull chapter on climate—a subject that can be made so interesting. On the whole the book is more interesting pedagogically than any text that has come to the reviewer in a long time. The ultimate in geography as with other subjects is to develop the intellectual process in the student's mind. This book is a long and important step in that direction.

RODERICK PEATTIE

JAMES, PRESTON E. *Outline of Geography*. xvi and 475 pp. Published by Ginn and Company.

Among the many textbooks which introduce geography to the college student, the Outline of Geography by Preston E. James will stand out because of the originality of its approach. In contrast to the common method of discussing principles and applying them to the world at large, the author presents regional world descriptions in which he has skillfully included elements of physiography, climate, soils, and distribution of natural vegetation. An appendix treats the atmosphere, lithosphere, and hydrosphere more particularly, in very compact form.

The world regions are based on natural vegetation but throughout the book the author relies upon climatic criteria. The use of the Köppen system almost as "Leitmotiv" of the book is scientifically correct but may prove rather involved and advanced for the college freshman.

The great advantage of the book lies in the freshness of its presentation and the excellency of its illustrations. To read it is a pleasure, and its wealth of exact information conveys new meanings and interpretations even to the trained geographer. As regards the illustrations, the book surpasses any other text in the field in the number and clearness of its maps. The physiographic maps of Erwin J. Raisz are a contribution in themselves; the excellent world maps of natural vegetation, of the Köppen climatic conditions, and of the surface configuration are very attractive, while among the many others, the presentation of type studies taken from survey sheets add to the value of the book. A minor objection must be raised that the economic dot maps are rather small and not always accurate (see, for instance, rubber in Sumatra and wheat in India), while the selection of Kendrew's rainfall maps is unfortunate in that they are no longer up-to-date, and the shape of some parts of the world is almost unrecognizable.

Excellent is the list of references at the end of

the book; it is a pleasure to observe the frequent reference to foreign publications throughout the book. Some doubt may be expressed that the book is suitable for the teaching of beginners' classes. It lays a heavy burden on the teacher, who is faced with the necessity of explaining the many principles involved while the student at the same time has to digest a mass of unfamiliar material. But the book is so good and such a contribution to the teaching of geography that it should find the place it deserves.

Finally strong protest may not be omitted against the last sentence of the Foreword by Stanley D. Dodge; namely that this book "is a beginning, in English at least, of a well ordered and systematic geography." This is an affront to the many American geographers who have done good work for many years past, and it is very unfortunate that this statement is made so unqualifiedly.

SAMUEL VAN VALKENBURG

BERGSMARK, DANIEL R. *Economic Geography of Asia.* xxiv and 618 pp. Published by Prentice-Hall, Inc.

This book is especially welcome as the first American textbook on the large continent of Asia. It is the result of an industrious study of source material; the outcome is a well-balanced interpretation of Asiatic economic development. The style is clear and simple; the material is well organized; the numerous maps and diagrams are a great asset; in fact it has all qualities which will make it successful for courses which stress the economic side of geography, and that is the intent and purpose of the author. The book does not go beyond the scope of the title: it does not try to interpret the human element which makes Asia so fascinating. The real story of Asia is not yet written, and may not be written for a long time to come because of the vastness of the continent and the complexity of its interpretation.

The main emphasis of Bergsmark's book is on the countries themselves. The treatment is generally satisfactory and complete. Less satisfactory are the general chapters. The treatment of relief (physical framework) fails to give an adequate picture, while the relief maps, based on elevation only, do not present in many cases the physiographic features. The discussion of climate is too short to be of much use. Each chapter is followed by a list of references which reflects the great care the author has taken to be well informed. Nevertheless some omissions should be mentioned. The continent of Asia by L. W. Lyde (1933) deserves in any case a place among the general references. Blanchard's brilliant "Asie Occidentale" (1929) Grenard's "Haute Asie" (1929) and Almeida's "Russie" (1933), all three part of Geographie Universelle, should not have been omitted. While some German authors are mentioned, others, not included, have added also considerably to our knowledge of Asia. I think here of Krebs and Wehrli for India, Credner for Siam, Schmitthenner and Wagner for China, and Machatscheck for Russian Turkestan; also Engelbrecht's classic study of Indian Agriculture, although old, is still the outstanding work in that field. Finally, speaking "pro domo," do not the Agricultural Regions of Asia of Cressey, Hall, and myself deserve more than two minor references?

SAMUEL VAN VALKENBURG

ECONOMIC GEOGRAPHY

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The July issue of Volume 11 contains the following articles:

Social and Economic Factors in Land-Use Planning in the Northeastern States, Jacob G. Lipman, College of Agriculture, New Brunswick, New Jersey.
Agricultural Regions of Asia: Part VIII—Malaysia, Samuel van Valkenburg, Clark University, Worcester, Massachusetts.
The Pacific Coast Halibut Fishery, John Q. Adams, University of Missouri, Columbia, Missouri.
Industrial Development in São Paulo State, Brazil, Preston E. James, University of Michigan, Ann Arbor, Michigan.
Population Adjustments in Our Virgin Islands, Earl B. Shaw, State Teachers College, Worcester, Massachusetts.
Cities of the Puget Basin, George T. Renner, National Resources Board, Washington, D. C.
Huepac: An Agricultural Village of Sonora, Mexico, Leslie Hewes, University of Oklahoma, Norman, Oklahoma.
Distribution of Deerfield River Power, A. K. Botts, New York State Normal and Training School, Cortland, New York.
The Coal Resources of China, W. Belden and M. Salter, Scripps College, Claremont, California.
Economic Geography of Bulgaria, Joseph S. Roucek, New York University, New York, N. Y.

April includes:

Salmon Industry of the Pacific Coast, Otis W. Freeman, State Normal School, Cheney, Washington.
Agricultural Regions of Asia: Part VII—The Japanese Empire, Robert Burnett Hall, University of Michigan, Ann Arbor, Michigan.
Water Power Development on the Deerfield River, A. K. Botts, Cortland State Normal and Training School, Cortland, New York.
A Distressed Industrial Region—Tyneside, George H. J. Daysh, Armstrong College, University of Durham, Newcastle-upon-Tyne, England.
Cultural Adjustments to the Mesabi Resources, Paul H. Landis, National Resources Board, Brookings, South Dakota.
Central Florida Farm Landscape, Samuel N. Dicken, University of Minnesota, Minneapolis, Minnesota.
The Chewing Gum Industry, Charles Landon, Duke University, Durham, North Carolina.
Geography of the Glaciated North Idaho Panhandle, J. Wright Baylor, U. S. Soil Erosion Service, Pullman, Washington.
Agricultural Land Utilization in Denmark, Daniel R. Bergsmark, University of Cincinnati, Cincinnati, Ohio.

January includes:

Geographical Controls of Agriculture in Orkney and Shetland, Andrew C. O'Dell, Birkbeck College, University of London, England.
Seattle as a Port City, Albert L. Seeman, University of Washington, Seattle, Washington.
Agricultural Regions of Asia: Part VII—The Japanese Empire, Robert Burnett Hall, University of Michigan, Ann Arbor, Michigan.
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The October issue of Volume 10 contains the following articles:

Agricultural Regions of Asia: Part VII—The Japanese Empire, Robert Burnett Hall, University of Michigan, Ann Arbor, Michigan.
Agricultural Occupation of Hokkaido, D. H. Davis, University of Minnesota, Minneapolis, Minnesota.
Spring and Winter Wheat on the Columbia Plateau, Victor Roterus, State College of Washington, Pullman, Washington.
Geographic Aspects of Coal Cargoes From Toledo, Walter G. Lezius, University of Toledo, Toledo, Ohio.
The Sweet Corn Industry of Maine, Albert S. Carlson and John Weston, Dartmouth College, Hanover, New Hampshire.
Future of Lake Superior Iron Ore Supply, George H. Primmer, State Teachers College, Duluth, Minnesota.
The Los Angeles Harbor Fishing Center, Clifford M. Zierer, University of California, Los Angeles, California.
The Development and Decline of Skaway, Alaska, Edwin J. Foscue, Southern Methodist University, Dallas, Texas.

July includes:

Scottish Carse Agriculture: The Carse of Gowrie, Henry M. Leppard, University of Chicago, Chicago, Illinois.
The Tobacco Growing Industry of North Carolina, Charles E. Landon, Duke University, Durham, North Carolina.
The Structure of Rhine Traffic, Edna E. Eisen, Steuben Junior High School, Milwaukee, Wisconsin.
Land Economy of Warren County, Kentucky: Part III, J. Sullivan Gibson, Kanawha College, Charleston, West Virginia.
Pineapple Industry in Hawaii, John Wesley, Coulter University of Hawaii, Honolulu, Hawaii.
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